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Franklin Institute

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

UNDER THE PATRONAGE

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FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA.

EDITED BY DR. THOMAS P. JONES,
PROFESSOR OF MECHANICS, IN THE INSTITUTE.

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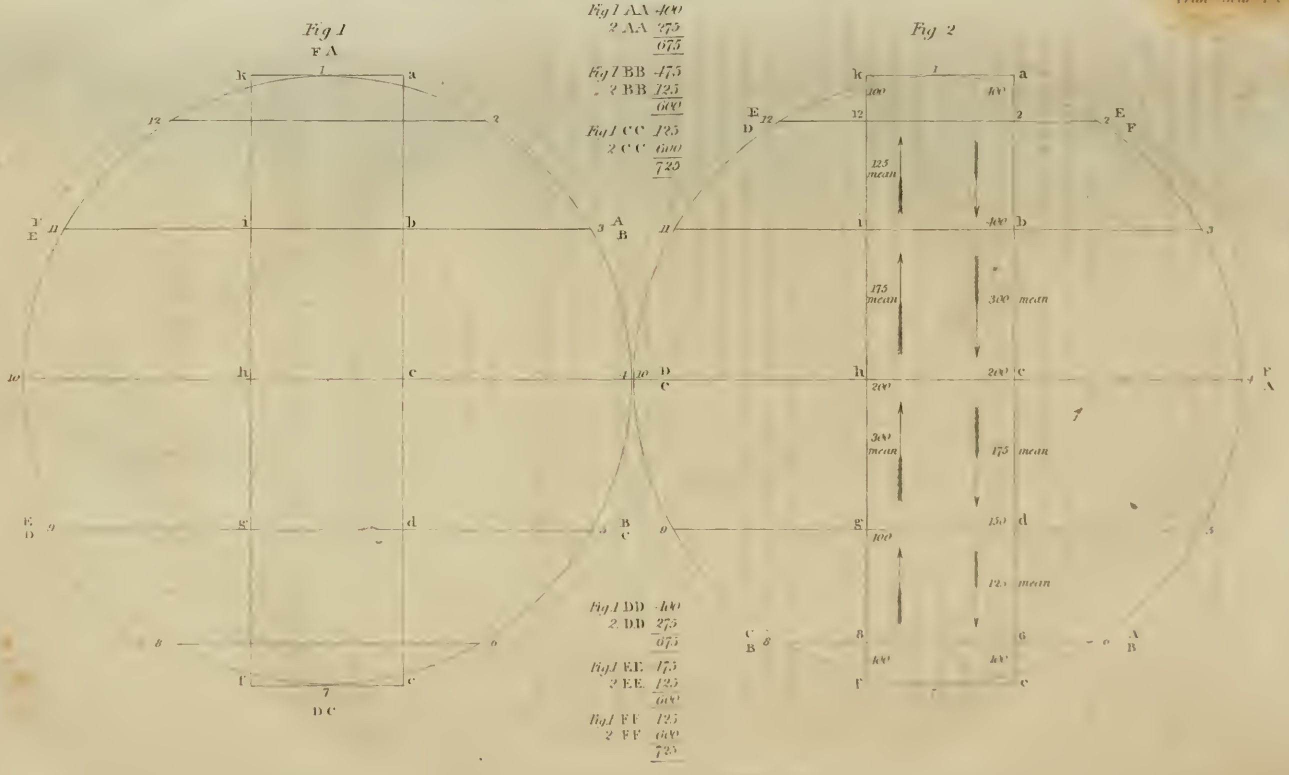
Fig 1

Fig 2

Fig 1 AA 400
2 AA 275
675

Fig 1 BB 475
2 BB 125
600

Fig 1 CC 125
2 CC 600
725

Fig 1 DD 400
2 DD 275
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Fig 1 EE 175
2 EE 125
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Fig 1 FF 125
2 FF 600
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JULY, 1827.

On the Progressive Compression of Water with High Degrees of Force, with some Trials of its effects on other Fluids. By J. Perkins, Esq.

The instrument with which Mr. Perkins made the experiments of which we propose to give an account, was constructed with much care, and attention, and is described with great minuteness, in the *Philosophical Transactions* for 1826, p. 541. The water was placed in a glass piezometer, consisting of an elongated bulb, nearly four inches long, and about three-fourths of an inch in diameter, and terminating in a tube of regular bore, nine inches long, and about one-eighth of an inch of internal diameter. By weighing the quantity of quicksilver contained in this instrument, when full, and ascertaining the weight contained in a given length of the tube above, it was found that the whole content was equal to a tube of 190 inches long, having the diameter of the contracted part of the piezometer. In the bottom of the piezometer, is a small disk of steel, and above it, a delicate hair spring, of sufficient strength, to retain its position, after being pressed upwards on the tube, so as to serve as a register, of the degree of compression that has been effected. The piezometer is now filled with water, and with its register and disk, it is placed in a phial containing a small quantity of quicksilver. It is next placed in the receiver of the compressing press, and after the proper pressure has been applied the piezometer is removed, and the indicating spring is found raised in the tube, more or less, according to the power employed.

The greatest amount of which this apparatus admitted, was 1000 atmospheres, being equal to 14,000 pounds to the square inch. With this apparatus, Mr. Perkins obtained the following results, which are the means that we have calculated from his tabular numbers. The column of water is 190 inches, and the numbers in the tables are the compression produced by the number of atmospheres around.

Atmospheres.	Compression. Inch.	Atmospheres.	Compression. Inch.	Atmospheres.	Compression. Inch.
10	0.189	80	1.187	500	5.087
20	0.372	90	1.288	600	5.907
30	0.543	100	1.422	700	6.715
40	0.691	150	1.914	800	7.402
50	0.812	200	2.440	900	8.243
60	0.956	300	3.339	1000	9.002
70	1.056	400	4.193	2000	15.833

If we make the number of atmospheres the abscissa of a curve, and the compressions, its ordinates, it will be found that the curve approximates to a hyperbolic one.

In order to estimate higher degrees of compression, Mr. Perkins constructed another piezometer eight inches long, ground internally perfectly cylindrical, and stopped at its upper extremity, with a flat disk of glass cemented into it. This tube he filled with water, and subjected it to a pressure of 2000 atmospheres. After repeating this experiment a great number of times, the average result was, that *the column of water,* EIGHT *inches long, was compressed two-thirds of an inch or one-twelfth of its length.* If we reduce this result to the scale of the preceding table, we shall find it to be 15.833, as there inserted.

With the same apparatus Mr. Perkins made experiments on the compression of other fluids. The most remarkable result he obtained, was with *concentrated acetic acid,* which, after compression, with a force of 1100 atmospheres, *was found to be beautifully crystallized,* with the exception of about one-tenth part of fluid, which, when poured out, was only slightly acid.

He next applied his apparatus to the compression of æriform fluids. For this purpose a gasometer was filled half full of water. It was then inverted and placed in a receiving tube, and it was found, under a pressure of 500 atmospheres, *that the whole of the air was taken up by the water, but none of it was given out* when the pressure was removed.

As it might be supposed that even glass was pervious to water, by such a force, a small phial was made air-tight by fitting into its neck, a well ground glass stopper. It *sustained a pressure of* 500 *atmospheres without change, and was perfectly dry within,* although it remained fifteen minutes under that pressure. When subjected to a pressure of 800 atmospheres, it was crushed to atoms.

During these experiments Mr. Perkins observed the curious fact, *that the air began to disappear* at a pressure of 500 atmospheres, a circumstance which he attributes to its *partial liquefaction.* At an increased pressure of 600 atmospheres, the quicksilver was suspended about one-eighth of the volume up the tube or gasometer; at 800 atmospheres, it remained about one-third up the tube; at 1000 atmospheres, two-thirds up the tube, and small globules of liquid began to form about the top of it; at 1200 atmospheres the quicksilver remained three-fourths up the tube, *and a beautiful transparent liquid was seen on the surface of the quicksilver, in quantity about* $\frac{1}{2000}$ *part of the column of air.*

The gasometer was now charged with carburetted hydrogen, and placed in a mercury bulb, with its mouth immersed in quicksilver. It was subjected to different pressures, and *it began to liquefy at about* 40 *atmospheres, and at* 1200 *atmospheres the whole was liquefied.*

Mr. Perkins is now occupied with the construction of a suitable apparatus for ascertaining the law of condensation of gaseous fluids, at high degrees of pressure. [*Brewster's Journal.*

On the Method of Striking the Medallions, termed by the French "En Cliché."—By Thomas Gill, Esq.

Our readers must have frequently seen the beautiful impressions, or medallions, from the Revolutionary, Napoleon, and other medals, struck during the late wars with France, and which were usually bronzed, mounted into the lids of snuff-boxes, and defended from injury, by being covered with convex glasses.

We have lately been highly gratified, by being permitted to witness the fabrication of these medallions; and from the information we then received, and particulars derived from other sources of intelligence, we trust to be able to furnish such an account thereof, as will enable others to imitate them.

It is a fact, that, either from a medal struck in any of the usual metals, from a *soft* steel die, or even from one of these medallions themselves, dies may be readily made, each of which will be capable of striking a considerable number of such medallions, and each of these, in its turn, be capable of producing a multitude of other dies, likewise fit to become the origin of as many successive medallions, and dies; so that, by this means, the original medal may be copied almost *ad infinitum!* Each remove from the original however, losing, of course, something of its sharpness, and accuracy of finish, although much less than might be supposed, and far less than by the usual methods of copying medals, by moulding and casting them.

We cannot but be surprised that so valuable an art, should hitherto, in this country, have remained in so few hands; as, from the succeeding details, it will be found to be abundantly simple, and easy to execute.

Of the metal used in forming the Dies and the Medallions.

This metal is composed of the ordinary *type metal,* which is an alloy of lead, and regulus of antimony, to which is added more and more lead, until on trial, by repeatedly breaking a plate cast from the mixture, it is found to bend a little, before breaking. This is one of the best criterions to judge by, as, from the variety of proportions of lead and regulus employed by different type-founders, no certain proportions can be anticipated, in the composition of the *broken types*, which are purchased for this use.

This compound metal is made, and melted, in a cast-iron pot, such as is used in cooking, and which is suspended over the fire, by its bail, or handle. The alloy, when a small quantity of it is taken up in an iron ladle, and kept in continual motion by shaking the ladle round and round, whilst it is cooling, at length assumes *a pasty consistence*, or a commencement of crystallization: this is the proper moment for employing it, either to form a die, or a medallion, by striking the original medal, or medallion, or a die upon it, in the manner to be hereafter described; when, from its pasty coherence, it cannot slip away from the blow, and is yet sufficiently plastic to receive the impression of the medal or die.

The compound metal, at the above period, does not retain heat enough to singe, or even to discolour the paper upon which it is laid, to receive the impression; and this again forms another valuable criterion to judge by, whether the alloy is rightly proportioned or not.

It would hardly be thought that this alloy, or composition, should be capable, both of forming the die or mould, and also of yielding numerous impressions from it, and yet such is the fact: a most remarkable discovery, and one, indeed, upon which the great merit of the art chiefly rests.

Type metal may consist of about five parts of lead, and one of regulus of antimony. The lead being melted in an iron vessel, the regulus must be stirred in it, continually, and be kept immersed in the lead, until it is at length dissolved, or melted in it: this, however, is a work of time, and very much depends upon the *due heat* given to the lead, which ought to be a little, though not much, above its melting point, lest it oxidate. The surface of the lead ought also to be covered with rosin, pitch, or grease, to prevent such oxidation as much as possible. The goodness of the type metal depends very much upon the quality of the regulus which enters into its composition. This metal, contains more or less *iron** or tin, (from the clippings of tinned iron plates being generally preferred, in this country, for making the regulus from the ores of antimony.) *Copper*, when used, particularly fits it for making a *whiter pewter*, than the regulus made with iron. We have seen, recently, a very superior kind of regulus, nearly free from any admixture with either of those metals; so that the nature of the type metal, as we have before said, is infinitely various.

These impressions are also taken, by the French, in what they term "*Darcet's alloy*," but which we know under the name of *Sir Isaac Newton's fusible metal*, being a compound of three parts of tin, five of lead, and eight of bismuth, and capable of melting in boiling water. This metal, although more expensive, is harder than that above described, and is capable of giving exceedingly sharp impressions. A still better metal would however, be, *G. Smith's solder for tin*, as it is not so liable to crystallize in cooling, as the fusible metal;

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* See an article by Mr. Gill, on alloys of cast-iron, with lead, tin, and regulus of antimony.—Vol. II. p. 374.

this is composed of one part each, of lead and tin, and two parts of bismuth.

On the machines employed for Striking the Dies and Impressions.

The well known button stamp may be used; but the one we saw, had only a single, square, iron rod, or stem, guided above in two square halved holes, and having a ring handle to raise it by. This apparatus was mounted upon the top of a three-sided close box, like a corner cupboard, set upon the floor, with a door opening in front; the rod passed through a hole made in the top of the box, and had appended to it, a brass, or gun-metal frame, having four screws on the under side of it, passing through, made in as many ears formed in the frame, exactly like the ordinary die dish, employed to hold dies, &c. in the lathe, in order to turn them. These screws crossed at right angles, their points all tending to the centre of the frame, which was made quite flat on its under side. A soft bell-metal, or gun-metal, cylindrical ring, was held, or suspended, between the four screws, and it also contained an inner gun-metal ring of the same depth as the former, but its inside was made in the shape of two inverted cones, the use of which will be hereafter described. The inner ring was held fast, by means of a single screw fixed in the outer ring, binding upon it. The frame had also a groove made around the upper, or cylindrical part of it, into which a catch, or detent, was fitted, which was mounted upon an axis in the centre, and its other, or outer end, was shaped into an inclined plane, hanging over the door of the box, and so contrived, that, instantly, on shutting the door, the detent was raised, and let the frame fall. The bottom of the box had a flat plate of cast-iron laid upon it, to support a tray of paper in the middle of it, and upon which the lump of heated alloy was placed, in order to receive the impressions, and the door and sides of the box were lined with sheet lead all around their lower parts, to catch the excess of metal which splashed around, from the force of the blow upon the heated metal.

Other machines of this kind have had the rapidity of the descent of the frame increased, by means of springs in the form of a bow, acting upon it.

The door of the box being opened, the detent was engaged in the groove made in the top of the frame, which also passed through the hole in the top of the box, and held it up, whilst the heated mass of metal was being laid upon the paper, but instantly released it, and suffered it to fall, upon shutting the door of the box.

We have now before us, the obverse of one of Buonaparte's medals, in the state in which it was produced from the blow. It is one and a half inches in diameter on its face, but widens behind to one inch and five-eighths, it being conical on its edge. It is one-eighth of an inch in thickness, this being intended to be reduced, by turning it away at its back, in a lathe of a peculiar construction.

We have said that the innermost of the two gun-metal rings, had its inside made in the shape of two inverted cones. The lowermost of these cones, gave the conical form to the edge, or rim, of the medallion, and was consequently one-eighth of an inch in depth. The uppermost, or reversed cone, was formed of the same angle, but was seven-eighths of an inch deep, the thickness of the ring being one inch. The die from which this medallion had been struck, was formed by carefully filing the conical rim of a similar medallion, until it accurately fitted the lower part of the reversed cone, the face of the medallion being let into the cone, even with the line of meeting of the two cones. Some of the metallic medallion alloy, was then poured into the remaining space in the cone above the medallion, until it filled it up, exactly even with the flat surface of the ring. By this judicious contrivance, the medallion was effectually prevented from rising, in striking the blow, by means of the flat face of the alloy, thus poured in above it, coming into contact with the flat undermost face of the carrying frame; and it was prevented from falling, by the cone in which it was held. In this state, the ring, and the medallion in it, being fastened in the outer ring, by the screw in it, and a mass of the melted alloy laid upon a thick paper tray, supported upon the flat cast-iron plate below, as above described, the frame, rings, and medallion, being first raised and held up by the detent, the blow was struck upon the melted alloy, and the excess of metal being scattered on all sides; in which it was aided by four shallow gaps, filed across the flat bottom of the ring, to permit the air and extra metal to escape the more readily; upon removing the impression from the die, by means of one of the portions of metal, which filled one of these four grooves, together with the conical or widening form of the mouth of the ring, a female impression of the medallion was thus produced; which, on being, in its turn, accurately filed on its rim, so as to fit into the uppermost cone of the ring, exactly, and, as was above described in fixing the medallion into it, and the space above it being also filled with melted metal, thus formed the die, from which our medallion was struck, and was evidently capable of striking many such. We have to add, that, although the outer ring was capable of receiving within it, other rings, of one uniform external diameter, that the inside cones of which were fitted to many different sized medallions, yet that various sizes of outer rings were also provided, in order to extend the capability of the apparatus to strike the larger medallions also.

Two differently fitted up lathes, were employed in this manufacture. The one, to turn the conical rims of the medallions to a cylindrical form, and to prepare them to be afterwards reduced at the other, to a proper thickness and flatness. The medallion was held central in the first lathe, by its circular border being received upon the sharp circular edge of a concave gun-metal dish, or chuck, screwed upon the lathe mandrel; which permitted the raised impression to be lodged in it, and it was pressed into contact with the dish or chuck, by a central point, urged against its back by a screw. In this situation the conical edge or rim of the medallion was readily turned cylindrical, by a tool properly held and guided in the lathe. There was afterwards little difficulty in holding these medallions, thus made cylindrical, upon their edges, in proper chucks, fitted upon the mandrel of the other lathe, and in applying a turning-tool to their backs, to turn them flat, and of a proper thickness. In case, however, of medals being to be formed of these medallions, the two parts, forming the obverse and reverse, were first cemented together at their backs, and then placed in a third lathe, furnished with two similar concave gun-metal dishes or chucks, the one placed behind, and the other in front of the medallion, to support it; and the one of them being screwed upon the lathe mandrel, and the other having a hole in its centre, which was lodged and turned upon the conical back centre of the lathe: the double rims could thus be turned together, to a perfect cylinder.

Die Sinkers may avail themselves, with advantage, of this method of taking impressions from their *soft* dies, during the progress of their execution; and indeed we have an impression from a die of the late Mr. Johnnis, of Hafod, thus produced, by that excellent artist, the late Mr. Mills.

Large types, or blocks for printing, may also thus be multiplied, with great facility and correctness, even more so, than by stereotyping them.

We subjoin the following article, *on Bronzing these Medallions*, observing, by the way, that it is stated to be for *bronzing tin*. The French applying the term *L'Etain* indifferently both to *tin* and *pewter;* a practice which frequently leads to great inconvenience in translating from that language. [*Technical Repository.*

On Bronzing the Medallions Struck in Soft Type Metal, or Fusible Metal.—By M. VERBY, *Jun.**

To perfectly succeed in bronzing these medallions, we must employ the two following solutions: the first, which serves as a preparatory wash; to be used as hereafter described, is composed of one part of sulphate of iron, one part of sulphate of copper, and twenty parts (by weight) of distilled water.

The second solution, which is the bronze, is less complicated; it is composed of four parts of verdigris, and sixteen parts (by weight) of white French vinegar.

The Manner of Employing these Solutions.—When the medallions have been filed and polished, on their edges, and strongly rubbed with a brush, wetted with a mixture of tripoli, or rotten-stone, and water, and well washed and dried, we pass the first solution slightly over both their faces, with a hair pencil, and then wash and wipe the medallions dry; this gives them a slightly blackish colour, and causes the verdigris to adhere more quickly to them. They are then rubbed with another hair-pencil, wetted with the second solution, until they become of a deep copper colour; they are then left to dry for an hour, after which they are polished with a soft brush, and red lead, breathing upon them frequently, to slightly moisten them, and cause the red lead to adhere to them; the polish is lastly finished with a soft brush, alone, passing the brush from time to time over the palm of the hand. To prevent the bronzes from being attacked by humidity, they may be covered with a slight coat of gold coloured lacker.

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* From "*Recueil des travaux de la Soc. de Lille,* 1825.

The *cliches* made with Darcet's alloy, or fusible metal, are bronzed with the second solution only, and do not require to be varnished, to preserve them from the effects of humidity.

Note by the EDITOR.

The plumbers give their soft soldered joints, near the cocks, the appearance of copper, by wiping over them a mixture of sulphate of copper in powder, with vinegar. Might not this be applicable to the above purposes?

The above medallions are frequently bronzed by coating them with a thin layer of gold size, and then applying bronze powder with a dry hair pencil, in the usual manner of bronzing plaster figures, &c.
[*Technical Repository.*

On an excellent mode of Coating small articles of Metal, with Tin.

By THOMAS GILL, ESQ.

The Editor once witnessed the following superior mode of tinning with great economy and convenience, small articles, such as tacks, nails, &c.

The workman having previously made the surfaces of the articles clean from rust, or other oxide, by pickling them, or putting them into sulphuric, muriatic, or nitric acid, diluted with water, as usual, and washing them well afterwards in water, he put them, together with a proportionate quantity of bar, or grain tin, and of sal-ammoniac, into a stone-ware gallon bottle, having an oval body, a narrow neck, and a handle to lift it by. He then placed the vessel, lying upon its side, over a charcoal fire, made upon a forge hearth, and heated it; continually turning it round all the while, and frequently shaking it, to distribute the tin uniformly over the surfaces of the articles to be tinned. They were then thrown into water, to wash away all remains of the sal-ammoniac, and finally dried in saw-dust, made warm.

The great merit of this process, consists in the employment of the *stone-ware vessel*, which not only prevents the dissipation of the sal-ammoniac, in fumes; but also gives up the whole of the tin to the articles to be tinned, which would not be the case were a *metallic vessel* to be used. [*ib.*

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

Manganese.

Section VI.—This substance can scarcely be reckoned a direct agent in bleaching, but as the most important agent used in the art is made from it, in an essay of this kind it would be unpardonable to omit its consideration. The best manganese is raised at Upton Pine in Devonshire, from a mine which seems adequate to the supply of the whole island for a century to come; most other kinds are of little use to the bleacher, as they require a greater proportion of sulphuric acid to saturate them, and withal, produce less oxygen. It is the black oxide of manganese which is used in the manufacture of chlorine, and it is this oxide which is procured from the mines. Besides the mines at Upton Pine, there are manganese mines at Bristol, and in Ayrshire, Aberdeenshire, and in various parts of Europe and America. That from Bristol and the Mendip hills is the worst, as it is generally contaminated with lead. The black oxide, when good, is of a bluish black colour, and shining lustre; when saturated with oxygen, it contains 44 parts of that substance, and 66 of the metal; but as it comes from the mines, it more commonly contains about 40 per cent. of oxygen, or even less. The substances with which it is most liable to be contaminated, are the oxides of lead, iron, and the carbonate of lime; and when it contains any of these, in quantity, the quantity of chlorine which it is capable of developing is proportionally less.—The carbonate of lime may be detected in the oxide of manganese, by pouring on it a quantity of nitric acid diluted with ten parts of water, when, if chalk is present, an effervescence will take place, and the lime will combine with the test liquor; while no effervescence will follow if lime is not present. In the former case, let the test liquor stand on it till it has taken up all the lime in the specimen, and then precipitate this lime by adding carbonate of potash to the solution. The weight of the precipitate will indicate the extent of the contamination. The presence of lead may be discovered by the sulphuric acid, or by Harrowgate water, with either of which it will form a dark brown or black precipitate, insoluble in water. Or take equal parts of oyster shells and sulphur, keep them in a white heat for a quarter of an hour, and when cold, add to the mixture an equal quantity of supertartrate of potash. Boil the whole in a strong bottle with rain water, for an hour, when there may be added to the liquid, twenty drops of muriatic acid for every ounce, to prevent the test from affecting any iron which may be present. This re-agent produces from lead, a black precipitate, and will detect the most minute portion of that metal.—(Watson's Chem. Ess. III.)

The ores of iron, are less easily detected in the oxide of manganese. When the iron, however, contains a proper proportion of oxygen for rendering it soluble in muriatic acid, we may thus discover its presence. By means of heat, make a solution of the oxide of manganese to be tried, in strong muriatic acid; add to the solution, a considerable proportion of distilled water, and pour into this liquid, a solution of crystalized carbonate of potash. If the manganese contains iron, it will, by this means, be precipitated in the state of an oxide, while the manganese will remain suspended by the excess of carbonic acid. Or the iron may be separated by the nitric acid, (oxymuriatic acid,) with the addition of sugar, which will combine only with the manganese.

Chlorine, (Oxymuriatic acid) and its compounds.

Section VII.—Next to oxygen, chlorine is perhaps the most interesting of all chemical agents. The theoretical researches to which it has given rise, are the most profound, and the least satisfactory, of all the subjects of chemistry. With this at present we have nothing to do; but we shall find its use in manufactures, and chiefly in bleaching, no less interesting, and surely more important, than the ingenious theoretical discussions which it has produced. This substance has been called an acid, but it wants one of the most marked properties of this class of bodies, namely, the conversion of vegetable blues, to red. Chlorine dissolves all vegetable colours, and renders them white; hence its use in bleaching, and its distinction from all other acids. In the gaseous form, it is of a greenish yellow colour—whence its name; and, although it supports combustion, it cannot be respired, without great injury to animal life. For the purposes of bleaching, it is made by an apparatus invented by Berthollet, and subsequently improved by Des Charmes, Fisher, and others. A description of the latest improvements in this apparatus has already been given. I shall now briefly state the process. The black oxide of manganese and muriate of soda, are mixed together in the proportion of 2 to 3, and after moistening them with water, they are wrought till the mixture is of the consistence of moist dough, in order that the manganese may unite more intimately with the salt. The mixture is perfect when it is uniformly black. In this state it is put into the retort. There is now gradually added 2 2-7 parts of sulphuric acid, which has previously been diluted with its own weight of water, and allowed to cool, in order to prevent accidents. This, immediately, without the application of heat, disengages chlorine from the mixture, in the state of gas; as soon as the quantity of gas thus disengaged, diminishes, a fire is kindled under the water-bath in which the retort is placed, and continued till all the procurable gas come over. This gas, impelled by its expansive force, passes from the retort to the large leaden receiver, where it is combined with water, with lime, or with some of the alkalies. The rationale of this process, is, that the sulphuric acid having a greater affinity than muriatic acid, for the soda of the muriate, combines with the soda, and sets free the muriatic acid, which, according to Davy, parts with its hydrogen to the manganese; according to the old theory, it attracts the oxygen of the manganese, forming chlorine gas. This gas it was which was formerly used in bleaching, pure and without admixture, but this is now, I believe, wholly laid aside, and a combination of it with water, potash, soda, magnesia, or lime, is preferred. These it will be necessary to discuss in their order.

1. *Berthollet's Bleaching Liquor.*

The chlorine diffused through water, was the mode of using it invented by Berthollet, and still followed in some old establishments. The bleaching liquor formed in this way, may be either made of the proper strength for use at first, or it may be made stronger and more concentrated by putting a smaller quantity of water into the receiver, or a larger proportion of ingredients into the retort; in which case it can be afterwards diluted to the proper strength. When this liquor is much concentrated, it has, like the gas, a greenish yellow colour, or what Werner calls a siskin green. It has also, like the gas, a very penetrating and offensive smell, arising, indeed, from the disengagement of the gas. It cannot be breathed, even for a few instants, without the danger of a most obstinate and violent cough, and sometimes causes the workmen to fall down senseless. Asthmatic affection of the breast, headache, tears and smarting of the eyes, bleeding at the nose, pains in the small of the back, and spitting of blood, are the ordinary symptoms which its respiration induces. So that unless the most careful and unremitting attention be paid to the lutes, it is impossible, even for a strong man, to support for several successive days, so unhealthful an employment. Des Charmes (p. 65) was so much affected by the violent expectoration thus produced, that he could retain no food on his stomach; he was deprived of sleep, and exceedingly afflicted with acrid humours flowing from his nose and eyes, so that he could not bear the light, while he suffered great pain in his back and thighs. These consequences are very serious, and they soon called forth the genius of invention to contrive preventives.—One of these was to introduce carbonate of potash or soda into the water in the receiver, in the proportion of one-fourth, to one of the muriate of soda employed. Even the sprinkling of a solution of any of those carbonates upon the surface of the bleaching liquor, previously to using it, will, in a great measure, neutralize the disagreeable effluvia. By this method, however, the alkali was not only totally lost, and the expense, in consequence, greatly increased, but the detergent power of the liquid was supposed to be considerably diminished, which was attempted to be proved by Mr. Rupp of Manchester, from numerous experiments. To obviate the primary evil, and to avoid the expense of its proposed cure, he contrived a very simple apparatus for exposing the goods equally to the liquid, and preventing the escape of the noxious gas, a description of which has already been given in its proper place. The application of chlorine condensed in water, however, may now be considered as one of the nearly obsolete agents in bleaching, although it is unquestionably more powerful than any of the oxymuriates.

2. *Oxymuriate* (*chlorate*) *of Potash.*

When the simple gas, and also water impregnated with it, were mostly given up, oxymuriate of potash, or soda, came to be used, as we have already seen in the history. The preparation of the bleaching liquor with these, is precisely similar to that employed in the impregnation of water; the leaden receiver being, in the former case, filled with a solution of one of these alkalies. The experiments of Mr. Rupp and others, to prove that the detergent power of chlorine is diminished by neutralizing it with an alkali, have been found practically erroneous. It is not unlikely, indeed, that they were deceived by the circumstance of the oxymuriates not producing so sudden an effect as the pure chlorine; but this is rather an advantage than otherwise, for the chlorine is disengaged so slowly and gradually from these salts, that time is given it to act equally and effectually on every part of the cloth. Little is lost, consequently, which is so copiously emitted by the escape of gas in the former case; and the operation is also rendered more healthy to the workman.—Lately, the combination of chlorine with the mineral alkali, has been much used in the calico manufacture, for clearing the whites of maddered goods, and it has almost superseded the tedious and expensive process of crofting. It is used in a state of great dilution, for although a strong solution would clear the whites more rapidly and more effectually, yet care must be taken not to make it strong enough to affect the colours which are to remain fast on the piece.

The strictest attention ought to be paid to the purity of the alkali used for making oxymuriates, as, if it be contaminated with neutral salts, the chlorine is not all taken up, and that which is left in an uncombined state, being greatly stronger than that which unites with the alkali, it will attack the colours of the printed goods, and in all probability discharge them.

3. *Oxymuriate* (*chlorate*) *of Magnesia.*

Sir Humphrey Davy found by experiment that the texture of linen was considerably injured when immersed in a hot solution of chlorine and water, by the corrosion, as he supposes, of the muriatic acid. Now this, he justly thinks, decreases considerably the advantage of the speedy and effectual bleaching which is thus produced. To remedy this, he instituted a set of experiments, and was so fortunate as to discover a substitute wholly free from this inconvenience, namely, the oxymuriate of magnesia. This may be procured by the method already described, by diffusing the magnesia through the water in the receiver, with which the chlorine combines and becomes condensed. It acts much more slowly and gradually than any of the other compounds of chlorine employed for the same purpose, and, consequently, must produce a more equal detergency. At Sir Humphrey's suggestion, it was employed to some extent for clearing the whites of printed calicoes in the large establishment of Mr. Duffy of Dublin, and with great success; for it was not found to injure, in the least, even reds and yellows, which had been fixed by mordaunts, while the oxymuriate of lime not only changes all the colours, and renders them of a duller hue, but also particles of the lime attach themselves so intimately to the cloth, that it acts as a discharge, and effaces the colours altogether. The oxymuriate of potash again, although not so strong an alterative, changes red to pink, and gives to purple, and lilac, a bluish shade; the alkali always diminishes the intensity and brilliancy of all colours. The oxymuriate of magnesia seems free from these imperfections.

Sufficient quantities of magnesia can be procured for this purpose from sea-water, or from the residual liquor of salt works; and perhaps the act which grants a drawback on salt to the makers of chlorine, (38th Geo. III. c. 89, s. 89,) may be found to extend to this use of sea-water; or, if not, a similar act may be procured, to pass when the advantage becomes manifest. It is not unlikely, if the oxymuriate of magnesia shall come into general use, that a similar method will be taken to manufacture it in the dry state, as is now successfully practised with respect to the oxymuriate of lime, in order to facilitate its conveyance to a distance.

ON HOUSE PAINTING.

[Continued from page 367. vol. 3.]

King's White derives its name from the use of it in the apartments of the French king. It is in all respects conducted like the former, except that there is only a small quantity of indigo, to take the yellow from the white, without any black of charcoal, and without varnish.

This white answers extremely well for apartments which are seldom used; but otherwise it spoils easily, especially in bed-chambers. It is the best white where there is any kind of gilding: and in this case, it may receive a little varnish.

The disagreeable smell perceived on entering rooms newly painted in distemper, is universally known. It is only after having left these rooms exposed to the action of the air, that they are habitable. A process which remedies these two inconveniences, deserves therefore to be adopted, and it is with that view that it has been published by M. Carbonell, a Spanish Physician.

The mode of operation described by the author, is very simple; it consists in substituting the serum of the blood of animals, instead of the solution of glue or size, commonly used to mix up the colouring matter.

To succeed, the following methods must be used:

1st. The butcher must be directed to receive the blood of one or more oxen in proper vessels. When the blood is quite cold, that is to say, three or four hours after it is drawn, the vessels must be gently inclined, by which means, a clear amber-coloured liquor will be decanted. This must be passed through a strainer to separate the impure fragments which have broken off and been mixed with it.

2d. Reduce to powder quick lime, which has been sprinkled with a little water to diminish the adhesion of its integrant parts. Pass this powder through a sieve, and deposit it immediately in boxes or bottles, well closed.

3d. When these two materials are to be used, the serum is first poured into a wooden or earthen vessel, and mixed with a sufficient quantity of lime, pulverized as directed above, taking care to preserve the mixture of a proper fluidity to be easily spread with the brush over the surfaces to be covered.

4th. Too great a quantity of this paint must not be prepared at once; because it thickens very fast, and when it has acquired too much consistence it cannot be used. This inconvenience may, however, be remedied by keeping the fluidity at the same point, by the addition of a sufficient quantity of serum, which should always be kept in a vessel near that containing the paint, that it may be used when necessary.

5th. The colour so prepared, should be used as quickly as possible.

6th. As the colour resulting from the application of this preparation is always white, and as there are circumstances in which a different colour is wished for, this may be obtained, by adding a bolar earth of a red, black, green, or yellow species to the serum, at the same time as the lime is mixed. Even a beautiful blue may be obtained by using the blue glass (*smalt*) prepared from oxide of cobalt, provided it be reduced to an impalpable powder.

7th. The strength of the composition being necessarily lessened by the addition of the bolar colouring matters, the same degree of solidity may be preserved by adding to the serum used for diluting this composition, a few whites of eggs; but particular care must be taken not to put too many, otherwise the paint will be subject to scale off.

8th. This paint can only be applied on wood work, or coatings of plaster, which have not been previously covered with oil-paint.

9th. As one layer will not be sufficient, two or three may be laid on those surfaces which are required to be well painted; but before laying on a second coat, that which has been already applied, must be perfectly dry.

10th. A beautiful polish may be given to the paint by friction, in the same manner as to other sorts of paint; it need only be observed, that it is better to grease the cloths used for rubbing it, with clear whale oil, rather than with any other material.

11th. To temper this paint, whether white, or coloured, it is necessary that the serum should be fresh, and not have undergone any change, otherwise the paint will be of a bad quality, and not durable.

The preservation of the serum, particularly in the summer, requires much caution, because this fluid has a great tendency to putrefy.

It is, therefore, essential to keep it in a cool place, and to examine before using it, whether it has begun to emit a bad smell; for, in that case, care must be taken not to use it. For the same reason the vessels in which the serum is kept must be carefully cleaned, and washed frequently with hot water; to remove the spoilt portions of this fluid, with which the pores of the vessels might be impregnated.

M. Carbonell asserts, that this paint is so durable, that, when prepared with good materials, it may be used to paint the walls of damp houses, without fear of its coming off; an advantage certainly not possessed by distemper painting.

The same author also asserts that he has made many experiments with this same paint, and has obtained satisfactory results; and in all cases so constant, that he doubts not, when it shall be known, that it will be generally adopted. He instances, among other examples, the use which is made of it at Barcelona, as well on the exterior of buildings, as within side, and he always observed, not only that the sun, the air, moisture, or draught, produces no change on it, but also that it is free from any bad smell; so much so, that places where it has been used, may be inhabited, without danger, the very day of its application.

We might be disposed, at the first glance, to believe that the new paint proposed by M. Carbonell, is nearly the same with that of milk, described some years ago by Cadet Devaux. This latter paint may have also succeeded; but on reflecting on the essential difference which exists between milk, and the serum of blood, it will soon be perceived that if the milk paint is good, that of M. Carbonell must be better. But experience must decide in this respect, and it is to be presumed that a short time will make known which of the two methods deserves the preference.

The work in which M. Carbonell has given the details relative to the preparation and use of his paint with serum, is dedicated to the queen of Spain. This work has been printed in the Spanish language; and it might advantageously find a place in the works of science which proceed from the press of this country.

We may now direct the reader's attention to the subject of painting in oil.

By means of oil, the colours are longer preserved; and not drying so speedily, they give painters more time to smooth, finish, and retouch their works; the colours being more marked, and mixing better together, give more distinguishable tints, and more vivid and agreeable gradations, and the colouring is more delicate.

The painting in oil consists of two kinds, namely, of that in simple oil, and of that in polished oil varnish. The following may be considered as important introductory details.

1. When bright colours, as white or gray, are ground and diluted in oil, it is adviseable to make use of the oil of walnuts; but if the colours be dark, such as chesnut, or olive, or brown, you must make use of pure linseed oil.

2. When the colours are ground and diluted in oil, they must be laid on cold, except on a new or moist plaster, which requires them to be heated.

3. Every colour diluted in pure oil, or in oil mixed with essence, ought to fall in threads from the end of the brush.

4. Take care to stir, from time to time, your colour before taking it up on the brush, that it may preserve an equal thickness, and consequently the same tone. Notwithstanding the precaution of stirring, if it is found to be thicker towards the bottom, it will be necessary to pour in, from time to time, a little oil, and thus preserve it of the same consistence.

5. In general, every subject which is painted in oil ought first to receive one or two layers of white ceruse, ground and diluted in oil.

6. When the painting is exposed to the air, as in doors, windows, and other works, which cannot be varnished, it is adviseable to make these layers with pure oil of walnuts, mixed up with about one ounce of essence to a pound of colours; more, would make the colours

brown, and occasion them to fall off in dust; but this quantity prevents the sun from blistering the work.

7. In subjects on the inside of the house, or when the painting is varnished, the first layer ought to be ground and diluted in oil, and the last, diluted with pure essence.

8. If copper or iron, or other hard substances, are to be painted, it is necessary to mix a little essence with the first layers, to make the oil penetrate into them.

9. When there are many knots in the subject, as is particularly the case with fir-wood, and when the colour does not easily make impression on these parts, it is necessary, when you paint with simple oil, to lay on a little oil mixed with litharge, on the knots. If you paint with polished oil varnish, it is necessary to apply a hard tint, which we shall have occasion to speak of afterwards. A single layer, well applied, is generally sufficient to give a body to the wood, and make the other layers apply easily.

10. There are colours, such as what the French call *stils-de-grain*, black of charcoal, and especially bone and ivory-blacks, which are difficult to dry when ground in oil. To remedy this inconvenience the following siccitives are mixed with the colours, to make them dry, viz. litharge both of the silver and gold colour, vitriol or copperas, and what is called *siccitive oil.*

It may be recommended not to mix the siccitives with the colours till they are to be employed, otherwise it will thicken them: but mix them only in very small quantities in preparations wherein there is much white lead or ceruse, because those colours are drying of themselves, especially when they are diluted in spirits of turpentine.

In painting which is to be varnished, give the siccitive only to the first layer, and allow the other layers, in which there is spirit, to dry of themselves.

In dark colours in oil, give to every pound of colours in diluting them, half an ounce of litharge; to bright colours, a drachm of white copperas ground in walnut oil.

When in place of litharge or copperas, the siccitive oil is employed, it requires a quarter of a pint of this oil to every pound of colour.

The siccitive oil is prepared of one half ounce of litharge, as much of calcined ceruse, as much of *terre d'ombre*, a colour with which the French paint shadows, and as much of talc, boiled for two hours on a slow and equal fire, with one pound of linseed oil, and stirred the whole time. It must be carefully skimmed and clarified, and the older it grows, the better it is.

Ochres and earths require more liquids both in grinding and diluting than ceruse. Different quantities of liquids are required in the grinding only on account of greater or less dryness; but in diluting, the quantity is always the same.

For the first layer after the priming, which has no relation to the colours laid on afterwards, to a square fathom give fourteen ounces of ceruse, about two ounces of liquid, to grind, and four ounces, to dilute it. If there is a second layer of the same materials, the quantities will require to be less.

It will require three pounds of colour for three layers of a square fathom. The first may consume eighteen ounces, the second sixteen, and the third fourteen.

To compose these three pounds of colour, take two, or two and a half pounds of ground colours, and dilute them in a pint, or three half pints of oil, mixed with essence, or pure oil. But if the first layer of ceruse is not used, there will be a necessity for a greater quantity of colours.

For painting in simple oil, on doors and windows, give a layer of ceruse ground in common oil diluted with the same fluid, together with a little siccitive; then give another layer of the same preparation; to which, if you want a grayish colour, add a little black of charcoal and Prussian blue, ground also in oil of walnuts. If to these the painter be inclined to add a third layer, grind and dilute it in pure oil; observing that the two last layers be less clear, or have less oil in them, than the first; the colour in this case is more beautiful, and less apt to blister with the sun.

Walls that are to be painted must be very dry; and this being supposed, give two or three layers of boiling linseed oil to harden the plaster; then lay on two layers of ceruse, or ochre, ground and diluted in linseed oil; and when these are dry, paint the wall.

To paint tiles of a slate colour, grind, separately, ceruse and German black in linseed oil; mix them together in the proportion which the colour requires, and dilute them in linseed oil: then give the first layer very clear to prime the tiles; and make the three next layers thicker, to give solidity to the work.

To paint arbours and all kinds of garden work, give a layer of white ceruse ground in common oil, and diluted in the same oil, with the addition of a little litharge; then give two layers of green, composed of one pound of verdigris and two pounds of white lead, ground and diluted in the same manner as the first portion. This green is of great service in the country, for doors, window shutters, arbours, garden-seats, rails, either of wood or iron; and in short for all works exposed to the injuries of the weather.

To whiten statues, vases, and all ornaments of stone, either within doors, or without; first clean the subject well, then give one or two layers of white ceruse, ground and diluted in pure or refined oil, and finish with giving one or more layers of white lead prepared in the same manner.

If you wish to paint on walls not exposed to the open air, or on new plaster, give one or two layers of boiling linseed oil, and continue to brush, till the walls are fully soaked; then give a layer of white ceruse, ground in common oil and diluted with three fourths of the same oil, and one fourth spirits; and lastly, give two layers more of white ceruse, ground in oil of walnuts, and diluted in oil mixed with essence, if it is not to be varnished; but in pure essence if it is. It is in this manner that walls are painted white. If you adopt another colour, it is necessary to grind and dilute it in the same quantities of oil and essence.

To paint chairs, benches, stone, or plaster, in a superior way, give a layer of white ceruse ground in oil of walnuts, and diluted in the same oil, into which you have cast a little litharge to make it dry; then apply a layer of the tint you fix on, ground in oil, and diluted in one part oil, and three parts essence; and afterwards give two more layers of the same tint, ground in oil, and diluted in pure essence: this may be varnished, with two layers of spirit of wine varnish.

To make a steel colour, grind separately in turps, white ceruse, Prussian blue, fine lac, and verdigris. The tone which you require is procured by the proper mixture of those ingredients. When you have fixed on the tone of colour, take about the size of a walnut of the ingredients, and dilute them in a small vessel in one part of turps and three parts of white oily varnish. *N. B.* This colour is generally made of white ceruse, of black charcoal, and Prussian blue, ground in thick oil, and diluted in essence, which is the cheapest method of procuring it; but the former, is the most beautiful.

(TO BE CONTINUED.)

ENGLISH PATENTS.

To JOHN HAM, *of Holton-street. Bristol, vinegar maker, for an improved process for promoting the action of acetic acid on lead, in the manufacturing of white lead, and also on other metallic bodies.* Dated June 13, 1826.

THE metal mentioned in the specification of this patent, on which the acid is to act, is lead, for the purpose of making white lead, or ceruse; and the acid employed is vinegar, which chemically differs considerably from acetic acid, stated in the title.* The process and apparatus for this purpose, are as follows:—

A chamber is to be prepared, whose size is not specified, but which, according to the proportions of the parts in the drawing, contains a cube, of about ten feet at every side; the bottom of this chamber, and about 12 inches in depth of the walls, are directed to be made of bricks, laid in "Roman cement," or other cement, on which vinegar will not act, which will then form a cistern, or receptacle for the vinegar, from the lower part of which a pipe proceeds horizontally, a little beyond the wall, furnished with a cock for the purpose of clearing out the spent liquor; and into the same pipe, between the cock and the wall, a vertical pipe, about 12 inches long, enters, whose use is to convey fresh vinegar into the cistern; the height that it rises in which, may be known by inspecting the depth of the liquor in this vertical pipe. Close to the bottom of the vinegar cistern, a long "*lead*" pipe is laid, so as to make several traverses at equal distances from each other, back and forwards, from side to side, (eight of which traverses are shown in the drawing,) and comes out again at the same side of the chamber at which it entered; into which long pipe, steam is made to enter at one end from a steam boiler, while the hot water from the condensed steam, runs out at the other end, and in its passage the steam heats the vinegar to 170° of Fahrenheit's thermometer.

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* This criticism of the English Editor, is incorrect. The acid contained in vinegar, is the acetic, and it is this which is evaporated, and acts upon the lead. The water, mucilage, &c. which vinegar contains, are mixtures, which dilute, and modify the action of the acid, but do not, chemically, change its nature. [*Editor.*

Matters being thus prepared, a bed of tan is to be laid in the bottom of the chamber, three or four feet thick, and the walls all around are to be lined with the same material, or with horse litter, or straw, to the thickness of 12 inches; which is to be supported in its upright position by boards. On a level with the top of the lower bed of tan, a wooden trunk, 5 or 6 inches in diameter, passes out horizontally, through the wall of the chamber, in which a stopper is fitted, having an aperture through it, about half an inch across; the use of which trunk is to admit a thermometer to ascertain the heat of the chamber, and to afford a passage for the entrance of air.

When the whole is thus disposed, the sheets of lead are to be put into the chamber; the lowest of which is to cover the bed of tan horizontally, close to three sides of the chamber; and to come within a short space of the fourth side, leaving an opening between them for the vapour of the heated vinegar to pass upwards; the next sheet of lead is to be laid over the first in a similar manner, a short space above it, where it is to be supported by staves, or by rolls of sheet lead, having laths, or battons, passing across them; but it is to be placed close to the wall, over the opening left by the first sheet, and to leave a similar vacant space at the opposite side; and in this manner all the rest of the sheets of lead are to be piled up, one over the other, until they reach near the top of the chamber; care being taken that they may each fit close to the walls at three sides of the chamber, and that the apertures left at the fourth side, may be at opposite sides alternately; by which means the hot vapour of the vinegar will pass from side to side, back and forwards, over and under all the surfaces of the lead sheets. The upper layer of lead is then to be covered with boards, on which a bed of tan or litter is to be placed to confine the heat, through which covering, a vertical pipe is to ascend, by which the state of the vapour from the vinegar may be ascertained by proper tests, but which is to be kept covered when not used for this purpose.

The number of the sheets of lead which are to be piled up, as before described by the patentee, is to depend on the nature of the vapour that comes out of the pipe last-mentioned, at the top of the chamber, which may be regulated by the quantity of vinegar put into the cistern, it being intended that the acid should be entirely decomposed by the lead before the vapour escapes, which is to be determined as before stated. The number of these sheets, exhibited in the drawing, is ten, which we suppose may be sufficient for a chamber of the dimensions there represented.

The patentee states also, that his plan for making white lead, or of causing vinegar to act on lead, may be combined with the method of making vinegar, described in the specification of his former patent, (of which we gave an account in vol. I. p. 219,) by substituting sheets, or rolls of lead, for the birch twigs, which are there directed to be placed in the upper part of the casks, or vessels, in which the vinegar is to be submitted to the action of his apparatus.

Remarks of the Ed. of Repert.—The Roman cement, directed to be used in forming the receptacle for the vinegar, above described, we consider very objectionable, as this acid would act speedily on that cement, or on any other that contains lime. If the patentee desires to have brick cisterns, united by cement, for the chambers to contain the vinegar, he should use either resinous, or wax cements; or perhaps he might find that pipe clay, dried, and kneaded with linseed oil, would answer the purpose; we, however, think, that brick cisterns are so liable to leaks from other causes, that they are not at all adviseable for the purpose recommended by the patentee. We also object to the lead steam pipes, directed to be passed through the vinegar, as when heated it would first oxidize them, and then quickly dissolve the oxide thus formed, so as speedily to destroy the pipes; of any of the metals cheap enough for an application of this nature, tubes of tin, would alone be proper for this purpose, as vinegar has but little action on the surface of this metal.

[*Repert. Pat. Inven.*

To Thomas Halahan, of York-street, Dublin, Lieut. in the Royal Navy, for machinery, or apparatus, for working ordnance. Dated June 22, 1826.

Lieutenant Halahan's apparatus for working cannon, or ordnance, is designed to make them run out of the embrasures, or port-holes, in a proper position for being discharged after being loaded, without requiring any manual labour for the purpose.

The cannon to which this contrivance is applied, is, as represented in the drawing attached to the specification, placed on a carriage, with four low wheels, such as is used in ships; which carriage is sustained by a narrow platform, of the length permitted to the recoil, rising a little above the deck, and turning horizontally on a strong pivot beneath the port-hole, so that it may be moved round to any angle with the latter, which the pointing of the gun may require. A long groove is made through the middle of this platform, in which a piece, descending from the middle of the gun-carriage, is fitted, so as to slide freely backwards and forwards, while a second piece, fixed across it beneath the platform, prevents the carriage from rising upwards, and confines its motion entirely to the direction of the long groove. Underneath the platform, near the pivot, round which it traverses, a cylindrical box is fastened in a horizontal position, in front of the long groove, containing a strong spiral spring of the kind used in clocks, and arranged in a similar manner to the boxes of such springs; round which box, a strong cord, or flexible chain, is rolled as many turns as the length of the groove will require, and its farther end is fastened to the piece that descends from the gun-carriage through the groove, when the gun is in the position that it assumes on being run out of the port-hole after being loaded.

The whole being so arranged, it is evident, that when the gun is discharged, its recoil will, by the cord, or chain, wind up the spring, by turning the box round, in which it is contained; and the gun being retained at the end of the recoil by a catch, which will be described, on withdrawing the catch it must of course be drawn up to its first position by the action of the spring, without any farther trouble.

The catch just mentioned, consists of a long narrow piece of metal, cut at one side into ratchet teeth, like those of a saw, which is fastened at one end, by a pivot, close to the side of the groove, underneath the platform, with its teeth in contact with the piece that descends from the gun-carriage, while its other end, which is that farthest from the port-hole, is sustained by a cross bar fastened underneath; and being drawn towards the groove by a spiral spring at the opposite side, a light chain passes from it over a pulley to a lever at the same side of the groove, where it is placed; which lever, being raised, draws the catch by the chain from the descending piece, by which it holds back the gun carriage, and immediately permits the main spring to act in drawing forward the gun out of the port-hole, as before mentioned.—*Ib.*

To Robert Hicks, of Conduit Street, in the County of Middlesex, Surgeon, for his invention of an Improved Bath.

The improvement proposed by the patentee, is the introduction of a flue in the bottom of a portable bath, or slipper, the water in which is to be heated by the flame of turpentine, or other combustible fluid, or by illuminating gas.

The general form of the bath is not intended to differ from the ordinary kind of portable vessels commonly used for chamber-bathing, which run upon castors, and are calculated to hold an adult person in a recumbent posture. The vessel may be made of copper or sheet iron, and have a broad thin flue made of metal tubes, extending over its bottom, and a recess in front, into which the combustible fluid is to be poured, with a board covering the flue, as a flooring to the bath, to prevent the surface of the heated metal from burning the bather.

A vessel on the side of the bath, is to hold a sufficient quantity of turpentine or other combustible liquor to feed what may be called the furnace beneath, for heating the cold water contained in the bath. The combustible liquor is delivered through a small pipe and cock, into the receptacle or furnace in front of the bath. and being there set fire to, the flame passes through the flue under the bath, and heats the water in a few minutes, the smoke and heated vapour passing off through a temporary chimney at the end of the flue into the fire place of the room.

Instead of turpentine or other inflammable liquor, the patentee proposes, under some circumstances, to employ a portable vessel filled with condensed illuminating gas, and to carry the burner under the bath, passing its flame through the tube as described above.

In this manner water may be heated for ordinary warm bathing, or any other medicated fluid may be employed, and after use, be drawn off by a cock in the lower part of the vessel.—*Newton's Journal.*

To Charles Macintosh, of Crossbasket, in the county of Lanark, in Scotland, Esq. for his Invention of a new process for making Steel.

The object of the patentee, is to communicate carbon to iron, when raised to a very high degree of temperature, by bringing into contact with the iron, gases which are impregnated with carbon. The gas which is proposed to be employed in this process, as most convenient and economical for the purpose, is that evolved from coal when under distillation.

To perform the operation, the patentee proposes no particular construction of apparatus, but merely that the iron which is to be converted into steel, shall be enclosed in a crucible or melting pot, made of the usual materials, and inserted in the furnace, and that when the temperature of the iron is sufficiently raised, a jet or current of the gas shall be thrown into the crucible through a suitable aperture, and tube, provided for that purpose, and that another aperture shall be made in the cover of the crucible, to allow that portion of the gas to escape which has not been taken up by the iron.

These are all the instructions given for the performance of the process, as the patentee claims the impregnation of iron at a high temperature, with carbon in a gaseous form.—*Enrolled November,* 1825. [*Ib.*

To William Pope, of Ball Alley, Lombard Street, in the City of London, Mathematician, for his having Invented certain Improvements on Wheeled Carriages.

The improvement herein proposed is designed to prevent the overturning of carriages, in the event of one of the wheels running upon a bank, or over a large stone, or any other elevation by which the side of the carriage might be raised, so as to endanger its falling over.

The plan proposed by the patentee (which is very imperfectly set out in the specification) appears to be a mode of connecting the axle-tree of the hinder wheels of the carriage, to the axle-tree of the fore-wheel, by means of a horizontal spindle or axle; by which mode of connecting the two axle-trees together, whenever one of the wheels is raised by running over an elevation, its axle-tree, in rising, turns in a vertical direction upon this connecting spindle, without lifting the other axle-tree, hence the body of the carriage is enabled to preserve its level position.

The same contrivance is said to be applicable to two wheeled carriages, but in what way it is to be adapted we do not perceive.

It is intended, if we are not mistaken, to fasten the shafts, or if a curricle, the pole to the body of the carriage, allowing the axle-tree to turn upon a horizontal pin or spindle, connecting the body of the carriage and the axle-tree together; and in that case the ends of the shafts are to be braced tightly to the shoulders of the horse, which is to be provided with suitable straps and harness for the purpose.—*Enrolled June*, 1826. [*Ib.*

To NATHANIEL KIMBALL, *of New York, in the United States of North America, but now residing in Falcon Square, in the City of London, Merchant; in consequence of a communication made to him by a certain Foreigner residing abroad, for the Invention of a process for converting Iron into Steel.*

THE converting of iron into steel, is by the introduction of carbon into the metal, which is usually done by surrounding the iron with charcoal, or some other carbonaceous matter, in a furnace. The improvement proposed by the patentee, is not in the mode of conducting the operation, but in the material, or composition, employed for that purpose.

Instead of charcoal, a mixture of one ounce of sal-ammoniac, one ounce of borax, one ounce of alum, and one quart of fine salt is to be prepared; which, after being enclosed in a retort or other vessel, and submitted to a red heat, is to be allowed to cool, and then to be pounded into a fine powder. Another mixture is also to be made, consisting of four quarts of soot, two quarts of the powder of burnt leather, two gills of burnt horses' hoofs, one pint of fine salt, one quart of vinegar, and two quarts of wine. These are to be stirred up together to the consistency of mortar, and when dried into a cake, are to be pounded as the former.

The two mixtures of materials are now to be carefully compounded together, and sifted over the surface of the several layers of iron which is about to be converted into steel, the iron being afterwards closed up in a vessel, and covered with sand, to prevent the access of air, or any kind of gas, to the interior of the vessel.

In this way, the patentee proposes to convert any kind of wrought iron articles, such as sword blades, or knives, into steel, taking care to cover the iron with the prepared compound, and to submit the articles, in closed vessels, to the action of the heated furnace; the time requisite for effecting the object, must depend upon the substance of the articles under operation, which can only be known by experience; from eight, to twenty eight hours, the patentee says will be required, and the quantity of carbonaceous material described above, will be sufficient for converting one hundred weight of iron.—*Enrolled April*, 1826.

The patentee, in proposing the employment of several of the materials which constitute the above described mixture, and the particular proportions of each as stated above, certainly does not mean for us to consider the common sense of the case, but to look upon it as a *magical* compound. Our readers will find all the essential parts of the materials above mentioned, described in the several patents for preparing iron and steel in our preceding volumes.—[*Ib.*

To JOHN BEEVER, *of Manchester, in the County of Lancaster, Gentleman, for his having Invented an Improved Gun Barrel.*

THE patentee's invention is the making gun barrels of an oval or elliptical figure in the bore, instead of circular, as usual, which he considers will discharge shots in a more effective range, than the circular barrels of the ordinary construction.

It is proposed, to take the ordinary kinds of gun barrels in their rough state, after they have been welded into the cylindrical form usually adopted, and to heat them red-hot, then pass an elliptical rod into the barrel by hammering or otherwise, so as to enlarge its diameter in one direction, and to compress it in the other; that is, press the circular tube into an elliptical figure. When the barrel has been thus formed, it may be completed by drawing, in the manner that tubes are commonly drawn, and then finished by the insertion of a breech in the ordinary way; after which the gun is to be fitted to a stock, and the other parts appended as usual.

The manner by which the barrel is formed into the elliptical figure, constitutes no part of the invention: that may be done by any convenient means, the substantial part of the invention being the employment of elliptically bored gun barrels, instead of circular bores as usual, and which the patentee considers will give a more effective range to the charge of shot than the old form.—*Enrolled April*, 1826. [*Ib.*

On the Economy of using highly Elastic Steam expansively. By JACOB PERKINS, Esqr.*

[*With a Plate.*]

THE diagram, figs. 1 and 2, in the plate, will show the economy of using steam expansively, and also the method of compensating for the inequality of the pressure on the piston, which, if steam of 400lbs. to the square inch is used, and stopped off at the quarter stroke, will end its stroke at 100lbs. per inch. The diagram will also show that the velocity of the piston is continually varying, while the crank is uniform in its motion.†

From repeated experiments and much reflection, I am led to believe that there is great economy in using very high steam, and that expansively; that the higher you can practically use the steam the sooner you may cut it off. The diagram shows the gain in cutting off the steam at quarter stroke. Let the piston, which is represented by the line *k.* 1 *a.* descend to *i. b.*, being one quarter of the stroke, with a constant pressure of 400lbs. per square inch. At this point, let the steam be cut off and expand to double its volume; when it arrives at *h. c.* it will be exerting a pressure of 200lbs. per inch, producing a mean of 300lbs. per inch, through the quarter stroke. Let the steam again expand to double its volume, and the piston will finish its stroke at *f. e.* at 100lbs. per inch, giving a mean of 150lbs. per inch for each quarter, which add to the other two quarters, 400. 300. 150. 150. and the whole sum will be 1000,* giving an average pressure of 250 per square inch. It will be seen that, when the stroke is completed, the cylinder will be filled with steam at a pressure of 100lbs. per inch, which will be the same in quantity as though the steam had begun with a pressure of 100lbs. per inch, and continued all the stroke at that pressure. By using the same quantity of steam expansively, beginning at 400lbs., there is a gain of 150 per cent. If the steam is used at 600lbs. per inch, and cut off at one-eighth of the stroke, 225 per cent. will be the gain. To compensate for the unequal pressure of the steam on the piston, two cylinders should be used, particularly for steam-boats and pumping, where the fly should be dispensed with. With the following arrangement, it will be seen, while one of the pistons is at its greatest power, the other is acting with a diminished power.

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* The above article is subjoined to that on the Explosion of Boilers, in the pamphlet received from Mr. Perkins.—[*Editor.*

† It is not pretended that this diagram is mathematically accurate; the object being merely to explain to the practical mechanic, in a sufficiently clear and concise manner, the principle of the advantage gained by using steam expansively.

The piston 1, fig. 1, in descending from *a* to *b*, moves in the same time through only half the space through which the crank moves, as will be seen by its path from 1 to 3. A force of 400lbs. is exerted on the square inch (that being the pressure of the steam,) in the first quarter of the stroke: at this point the steam is cut off, leaving the other three-fourths of the stroke to act expansively. The piston 1, fig. 2, having completed half its stroke, when piston 1, fig. 1, begins its stroke, and consequently a compensation, near enough for all practical purposes, takes place.

It will be seen, that while the piston 1, fig. 1, has performed one-fourth of its stroke, that the piston 1, fig. 2, has moved from *c* to 6, performing seven sixteenths of its stroke in the same time. The mean in each quarter, from *c* to *e*, fig. 2, being 150lbs., the amount of pressure to be added to the first quarter of the stroke of the piston, fig. 1, (which was 400lbs.) is 275lbs., producing an available power of 675lbs. at this part of the stroke. The piston, fig. 2, now moves but two-sixteenths of its stroke from 6 to *e*, and *f* to 8, while the crank moves through two of its divisions, from 6 to 8, which would, in another part of its path, move (within a fraction) with the same velocity as the piston. The piston, fig. 2, in moving from 6 to *e*, gives a power of 25lbs., being the last of the expansion which ends at 100lbs. per inch. The piston, fig. 2, in moving from *f* to 8, being the beginning of the stroke, gives a power of 100lbs.; thus a power of 125lbs. will be acting on the piston 1, fig. 1, while moving from *b*, to *d*, giving a power of 475lbs. to which add 125, will show a power of 600lbs. at this part of the stroke. The piston 1, fig. 1, now descends from *d* to *e*, being the last quarter of the stroke, giving 125lbs. of power to act with the piston 1, fig. 2, while moving from 8 to *h*, giving a power of 600lbs., add to this the 125lbs. and it will give a power of 725lbs. at this part of the stroke. The piston 1, fig. 1, now begins its stroke of 400lbs. per inch at *f*, and continues to *g*, with the same power, while piston 1, fig. 2, moves from *h* to 12 giving a power of 300lbs. to be added to the 400lbs., obtained at the first quarter of the stroke of the piston 1, fig. 1, at *f* and *g*, producing at this part of the stroke, 700lbs. of power. The piston 1, fig. 1, now moves from *g* to *i*, giving a power of 475, while the piston 1, fig. 2, moves from 12 to *k* and *a*, to 2, giving a power of 125, which add to 475, gives a power of 600 at this part of the stroke. The piston 1, fig. 1, now moves from *i* to 1, being the last quarter of the stroke, giving a power of 125lbs., while the piston, fig. 2, moves from 2 to *c*, producing a power of 600; to which add 125lbs. will make 725lbs. at this part of the stroke.

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* If the steam had continued the whole length of the stroke at 400lbs. per square inch, the sum would have been 1600lbs. consuming four times the steam with the addition of only 60 per cent. to the power.

By this arrangement, it will be seen, that a compensation is obtained, giving a more equable power than that which is produced by the single engine, whether high or low pressure, since it is well known, that at two points of the revolution of the crank, the power ceases, during at least one twelfth of the time, which is the reason that so large a fly-wheel is necessary. It is particularly applicable to steam-boats, and may be used to great advantage in the double pump, as well as the balance-bob lifting pump, used in Cornwall for mining purposes, by the use of proper gearing. The present single stroke expansive engines, used in Cornwall for pumping, are preferred to all others, on account of their economy, although they are very limited as to the extent of the expansive principle, for want of compensation, as nearly the same power is wanted to finish the stroke of the pump, as to begin it.

The variation of the velocity of the piston, occasioned by the compound motion of the crank, and connecting rod, is not taken into view in this diagram. As the connecting rod is intended to be four diameters of the path of the crank, the variation will make no practical objection, being, at its greatest value, but one-thirty-second part of its range. If the engine should be worked by a connecting rod, as is sometimes the case in steam-boats, say only one diameter of the path of the crank, the variation at each end of the stroke, would amount to a practical defect, since the piston would move with nearly three times the velocity at the lowest quarter of the stroke, that it would at the first quarter. Thus circumstanced, the crank must be above the cylinder.

As the law of expansion seems not yet to be settled, an arithmetical expansion has been used for this diagram, which, from its approximation to the real law, will be quite near enough for practical purposes.

Many who are of the school of Tillock and Wolf, believe that the expansive power of steam depends upon heat only; while the Soho experiments are said to prove that elasticity depends simply on density, without regarding temperature, viz., that if a cubit foot of steam at atmospheric pressure, weighs one ounce, 50 atmospheres of steam would weigh 50 ounces; but Dalton, who is undoubtedly much nearer the true law, would make 50 atmospheres weigh but about 34 ounces.

I have no doubt that the nearer the atoms of water are made to approach each other, by compression, the greater will be the repulsive action of caloric, and that, in a more rapid ratio than has hitherto been allowed, especially in highly compressed steam. Its comparative density with the increase of power, diminishes faster than has been supposed even by Dalton.

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—No. XVIII.

BY PETER A. BROWNE, ESQ.

On the Law of Patents for New and Useful Inventions.

[CONCLUDED.]

ON THE DEFENCE WHICH MAY BE MADE.

The different parts of the acts of Congress, respecting patents, may be thus arranged. The 6th section of the act of 1793, provides, that when any action is brought for a breach of the patent right, the defendant may plead the *general issue.* As the 3d section of the act of the 17th of April, 1800, (which was enacted to supply the 5th sec. of the act of 1793) provides, that the action shall be *on the case*, the general issue would be "*not guilty.*"

Under the general issue, the defendant may give in evidence, the act of Congress. He may also give in evidence, any special matter, tending to prove either of the following things, viz.

1. That the specification, filed by the plaintiff, does not contain the whole truth relative to his discovery.
2. That the specification contains more than is necessary, to produce the desired effect.
3. That the thing thus secured by patent, was not originally discovered by the patentee, but had been in use, or had been described in some public work, anterior to the supposed discovery of the patentee.
4. That the patentee had, surreptitiously, obtained a patent for the discovery of another person.

To the 1st and 2d defences, the act adds, that the concealment, or addition, must fully appear to have been made for the purpose of deceiving the public. And in order that the plaintiff may not be taken by surprise, by giving either of these defences in evidence under the general issue, the same section provides, that the defendant shall give to the plaintiff, or his attorney, notice in writing, of the special matter, thirty days before the trial.

The decisions under the foregoing heads may be thus arranged.

1st. *The specification or description does not contain the whole truth.*

In making this description, *no part* of the invention must be omitted, *the whole* must be described. Bul. n. p. 77. "If the specification be, in any part of it, materially defective, the patent is against law, and cannot be supported."

A patent was granted for making steel trusses, and the patentee omitted to state, that in tempering the steel, he rubbed it with tallow, and the patent was avoided. Liardet *v.* Johnson, cited in 1 Term. Rep. 602.

Nor must any mode that is more beneficial, be omitted. Brown took out a patent for a machine to make bobbin lace, and he omitted to describe the bending together two teeth of the dividers; and Lord C. J. Gibbs said, that "if this more beneficial mode of working was known to him, when he took out his patent, the patent would be void." 2 Marshall's Rep. 211. So in Turner *v.* Winter, 1 Term. Rep. 602, Buller, J. says, "If he makes the article with *cheaper* materials than those he has enumerated, the patent would be void."

2dly. *That the specification contains more than is necessary.*

In Turner *v.* Winter, 1 Term. Rep. 602, Buller, J. says, that "if the patentee could only make the article proposed, with two or three of the ingredients specified, and he has inserted others which will not answer the purpose, that will avoid the patent." So in King *v.* Arkwright, Buller, J. says, "if these things are of no use, but thrown in merely to puzzle, the patent is void."

3. *To make out a defence upon either of these grounds, under the act of Congress, it must be made to appear, that there was an intention to deceive the public.* Whittemore *v.* Cutter, 1 Gallisson's Rep. 429.

It must be understood, that although the act of Congress enumerates certain defences that the defendant may make, yet he is not confined to these. Judge Story, in the case of Whittemore *v.* Cutter, 1 Gallisson's Rep. 429, says, "It is very clear that the 6th section does not enumerate *all* the defences, of which the defendant may, legally, avail himself; for he may clearly give in evidence, that he never did the act attributed to him; that the patentee is an alien, not entitled under the act; or that he has a license or authority from the patentee."

THE JUDGMENT.

Although the patentee, *in England*, has been defeated in one action, he may maintain fresh suits against other persons; as was done by Mr. Arkwright, and by Mr. Watt.

In Arkwright *v.* Nightingale, Davis' Patent Cases 55, Lord Loughborough expresses himself as follows, "It has been said, that many persons have acted upon an idea that Mr. Arkwright had no right, he having failed to establish it when this cause underwent an examination in another place, in which the event was unfavourable to him. If the question at present were, what damages Mr. Arkwright should have received for the invading that right, I would have allowed the parties to have gone into evidence to show, to what extent persons had acted upon the faith of the former verdict; but the question now is upon the *mere right:* and if the result of this cause is in favour of the plaintiff, the verdict will be with one shilling damages. A future invasion of this right would entitle Mr. Arkwright to an action for damages, but in the present case they are not asked."

In the United States, the law is different: by the 6th sec. of the act of Congress of 1793, which is the one enumerating certain defences, which a defendant may make to a suit on a patent, it is declared, that "in either of which cases judgment shall be rendered for the defendant with costs, *and the patent shall be declared void.*"

OF THE REMEDY, IN ENGLAND, BY A BILL IN CHANCERY.

Beside the remedy, by action at law, for the infringement of a patent right, the English law gives another, which must now be noticed.

The patentee may file a bill in Chancery to establish his letters patent, and for a perpetual injunction against any one who undertakes to use his invention without his license.

In order to obtain the injunction, the party applying, must swear as to his belief, that he is the *original inventor.* Hill *v.* Thompson, 3 Merivale's Rep. 622. The Lord Chancellor observed, that "although when he obtained the patent, he might very honestly have sworn as to his belief of such being the fact, yet circumstances may have subsequently intervened, or information been communicated, sufficient to convince him that it was not his own original invention, and that he was under a mistake when he made his previous declaration to that effect.

To this bill filed by the plaintiff, the defendant may file his answer, denying the plaintiff's exclusive privilege; upon which the Lord Chancellor will direct an issue at law, to try the right. *If the patentee has been long in the exclusive enjoyment of his patent, an injunction will be issued against the party invading it, until the right is tried at law.* This was decided in Harmer *v.* Plane, 14 Vezey 130. This was upon a motion to dissolve an injunction, which had been obtained by the patentee of a machine for manufacturing woollen cloths, against one who had used it; and the Lord Chancellor observed, "there has been sufficient possession under this patent, to make it fit that it should be tried; taking care that it shall be tried speedily. It may be put in the shape of a case, stating the specification and facts, sufficient to introduce the question."

The injunction will be issued although the Chancellor has doubts whether the patent is good.

For this rule we have the authority of the case last cited. The Lord Chancellor prefaced the remarks above quoted, by this observation, "I feel very doubtful whether that (the allegation upon which the plaintiff founded his right) can be made good."

The same principle will be found in 6 Vezey, 707. The Universities of Oxford, &c. *v.* Robertson.

If the patent be clearly bad, the injunction will not be granted.

This may be collected from the case of Grierson *v.* Eyre, 9 Vezey, 341. It was a bill by the king's printer, in Ireland, to establish his right to print the statutes of Ireland, against the king's printer in England, and the court being clearly of opinion with the defendant, dismissed the bill.

Formerly the practice was, that the party was sent *to law* to establish his right, and then went into Chancery again, for account; as will appear by an anonymous case in 1 Vernon's Rep. 120. Upon a motion for an injunction to stop the sale of certain Bibles, the Lord Chancellor said "Let there be a trial at law, and let the king's patentee be plaintiff, and the defendants admit that they have sold 12 Bibles; *and when the trial is over, come back again.*"—

As the right under letters patent appears on record, it has been held unnecessary to establish the right at law, previously to filing the Bill.

An exception however, must be stated to the last rule, which is this, that the court will not grant the injunction, in the first instance, where the patent is recent.

This distinction is taken in Hill *v.* Thompson, &c. 3 Merivale's Rep. 622. It was a bill praying an injunction, to restrain the defendants from selling, &c. any iron smelted, or worked, by the plaintiff's improvement, and the Lord Chancellor said "Where a patent has been granted, and an exclusive possession of some duration under it, the court will interpose its injunction, without putting the party previously to establish the validity of his patent, by an action at law; but where the patent is but of yesterday, and upon an application being made for an injunction, it is endeavoured to be shown, in opposition to it, that there is no good specification; or otherwise, that the patent ought not to have been granted; the court will not, from its own notions respecting the matter in dispute, act upon the presumed validity, or invalidity, of the patent, without the right having been ascertained by a previous trial; but will send the patentee to law, and oblige him to establish the validity of his patent in a court of law, before it will grant him the benefit of an injunction."

The verdict of the jury between the parties at law, will be considered by the Chancery Court, as final and conclusive. Hill *v.* Thompson, 3 Merivale's Rep. 631. *But the Court of Chancery, will give an opportunity to move for a new trial, in the Court of Law.* 3 Merivale's Rep. 631.

During the pendency of the suit at law, the Court of Chancery will oblige the defendant, to keep an account of the profits. 3 Merivale's Rep. 6.

OF PROCEEDINGS IN EQUITY IN THE CIRCUIT COURT OF THE UNITED STATES.

The equity side of the Circuit Court of the United States, will take no cognizance of a suit in equity, relating to a patent, between citizens of the same state, as Congress have not expressly given them that power.

Livingston and Fulton, were the proprietors of steam boats on the Hudson, and claimed the exclusive right to navigate the waters of New York in that way, by virtue of two patents from the United States, and several laws of New York. Van Ingen, and others, built, and were using, on the same river, a steam boat for carrying passengers, and were building another. The former filed a bill on the equity side of the Circuit Court of the United States, praying to be quieted in the possession, and enjoyment, of these rights, and an injunction to restrain the defendants from constructing, and using, the boats. All the parties were citizens of the state of New York.

The defendants contended, that the Circuit Court of the United States, as a Court of Equity, between citizens of the same state, had no jurisdiction of the cause. Livingston, J. delivered the opinion of the court, confirming the plea of the defendants, that its jurisdiction did not extend to cases of this description.

Every patron of American genius, will join me in regretting, that the power of administering this *remedial* justice, does not reside in some court of the United States. The wisdom of the English law, in this particular, in giving authority to its courts to interpose their powerful arms, to restrain the piratical invader of a patent right, must, I think, be acknowledged by all. Nor can we withhold our approbation from the equal manner in which the Courts of Chancery dispense justice to the patentee and the public, as explained in the present essay. If the invasion is glaring, they stop the invader's progress immediately: if it is too doubtful, they order the defendant to keep an account of his profits, to answer the plaintiff in case his right shall eventually be made to appear: if the patentee's pretensions are unsupported, they refuse their aid. In all cases their final decisions depend upon the patentee's right as established at law; to try which, fairly, and speedily, they oblige each party to concede matters of form.

For want of such a power in the United States, we have, more than once, seen persons, in defiance of justice, openly invading the patent rights of their fellow citizens, and enriching themselves with the spoils, while the patentee is pursuing a long protracted action of damages. It is for Congress, in their wisdom to apply a remedy for this evil.

PROCEDURE IN CONTESTING A PATENT IN THE DISTRICT COURT.

Another method of contesting a patent, for the fourth reason enumerated in the sixth section, is pointed out in the tenth section, which provides that "within three years after issuing the patent, upon an oath or affirmation being made before the judge of the District Court, where the patentee, his executors, administrators, or assigns, reside, that the patent was obtained *surreptitiously* or upon *false suggestion*, the court, upon motion made, if the matter alleged appears to be sufficient, may grant a rule to show cause why process shall not issue to repeal the patent. And if sufficient cause be not shown, the rule is to be made absolute, and process is to issue against the patentee, or his executors, administrators, or assigns, with costs of suit. And if no cause is shown, or if it shall appear that the patentee is not the true inventor or discoverer, judgment to be rendered to repeal the patent. If the party complaining has judgment given against him, he is to pay all the costs."

The practice under this section is, for some person to make affidavit of the facts upon which the application is founded. Upon the presentation of this exparte affidavit to the District Court of the United States where the patentee, his executors, administrators, or assigns, reside, a rule is granted to show cause, on some day therein mentioned, why process should not issue against him or them, to repeal the patent. Upon the day of the return of this rule, if sufficient cause is not shown, the process issues. This process is a writ of scire facias to repeal the patent. To this writ the party, defendant, may plead, or demur, as best suits his defence.

If the question turns upon a matter of fact, a jury are summoned, and impannelled, as in other cases in that court.

In England this proceeding assumes the form of a writ of scire facias, which issues out of the Court of Chancery, to repeal a patent.

This writ, out of chancery, lies, in the ordinary course of justice, in three cases.

1. When the king, by several letters patent, grants the same thing to several persons, the former patentees have a sci. fac. to repeal the second letters. 4 Inst. 88.

2. When the patent has been obtained upon *false suggestions;* the king *jure regio*, may have the scire facias. 4 Inst. 88.

3. When the king grants any thing which by law he cannot grant, he, *jure regio*, may have the scire facias. 4 Inst. 88.

It would appear from an examination of the cases to be found in the English Books, of writs of scire facias to repeal patents, that any cause may be shown which would be a good defence in an action for an invasion of the patent right.

In King *v.* Arkwright, Westminster, 1785, cited Bul. N. P. 77. Davies on Patents, 61, three valid issues were joined: 1. That the patent was not new. 2. That the patentee was not the inventor. 3. That the specification was insufficient.

When any facts are disputed, issues are formed, and the parties are sent into a court of law to try them. If the issues are found against the patentee, the judgment is that the said letters patent be revoked, and declared void, and the enrolment be revoked.

But in the United States, in order to justify a judgment against a patentee, by virtue of this tenth section of the act of Congress, he must have been guilty of some *deception* or *misconduct;* he must have used some *false suggestion*, or been guilty of some *surreptitious proceeding.* This was decided by Judge Davis, in the case of the proceeding to cancel Odiorn's patent, in the District Court of the United States, for the Massachusetts District, in December term, 1811.—MS.

The same appears in the case of Jeremiah Bailey's patent. Upon the affidavit of Oliver Evans, "that Bailey had obtained his patent upon false suggestion, to wit, upon the suggestion that he is the original inventor thereof." A rule was granted by the District Court of the Pennsylvania District, to show cause why process should not issue against Bailey, to repeal his patent. This rule was made absolute by consent, and without prejudice, and an amicable scire facias was taken out, and filed, to which Bailey appeared, and pleaded not guilty. The cause came on to be tried before the court, and a jury for that purpose summoned and impanneled, on the 21st day of June, 1814.

It was contended, on behalf of the relator, that if Bailey had been the true inventor, and had taken out his patent erroneously, supposing that he was the original inventor, when, in truth, the invention had been previously made by another, that this amounted, in law, to *false* pretences.

Peters, Judge, charged the jury to the following effect;—that the subject lay within a narrow compass. The proceeding (he said) was of a summary nature, and it would have a very dangerous tendency to extend the enquiry to the length that had been contended for by the counsel for the plaintiff. The question was, whether Bailey's patent had been *surreptitiously* obtained. He said, that he understood the expression in the 10th section, "false suggestions," to be tantamount to surreptitiously; and that the sufficient cause which is to be shown, is, that the party had obtained his patent surreptitiously, or upon false suggestions. That the distinction taken between the *true* and the *original* inventor, was important only as regarded the mode of proceeding. If the patentee was not the *true* inventor, it would justify this summary proceeding. The utility of Bailey's patent was not, he thought, a proper subject of enquiry at that time.

ON SURRENDERING A PATENT.

It has been doubted whether a patent can be surrendered, but this was decided by Thompson, J., in Huntingdon *v.* Morris, MS. rep. C. C. U. S. N. York.

"I see no objection to entering a *vacatur* of the patent of record in the department of state, if taken out inadvertently, and by mistake: all the proceedings in that department, on the subject of patents, are *ex parte*, except in the case of interfering applications. The department act rather ministerially, than judicially, and upon the representation of the applicant, without entering into an explanation of the question of right: and I see no good reason, why, on a like *ex parte* application, the patent might not be surrendered, and cancelled of record, if no misconduct was imputable to the patentee in taking it out. The only record evidence of the patent, is that in the department of state, and in the letters patent in the hands of the patentee; and, if the letters patent are surrendered, and cancelled of record, the invention would be open to public use, without hazard, so far as depended on such patent.*

FOR THE FRANKLIN JOURNAL.

Observations on the received Theory of Falling Bodies, and an attempt to prove that it is, in part, incorrect. By Thomas W. Bakewell, Esq.

I submit the following remarks, with some degree of reluctance; and my hesitation in so doing has no slight grounds, for the principles set forth, and endeavoured to be sustained, are at variance with opinions which have been held to be indisputable, ever since the adoption of the Newtonian doctrine. I have, however, the more confidence in them, from their being in strict accordance with all the fundamental principles established thereby.

I contend that, all bodies falling by the attraction of gravitation, approach each other with the same velocity, in equal times, howsoever great, or small, the gravitating force may be; or howsoever great, or small, may be the quantity of matter contained in the bodies (or either of them) so attracted; and that the *rate* at which matter obeys gravitation, pervades the material universe, as fully as the attraction of gravitation *itself.* I also contend, and in consequence of the above opinions, that a (detached) pendulum, of given length, will not alter the times of its vibrations, in different latitudes, by reason of the oblateness of the earth at the poles, *increasing*, or the centrifugal force at the equator, *decreasing*, the effect of the attraction of gravity: nor would any increase, or diminution of the gravitating force, however great, alter the times of the pendulum's vibrations.

In endeavouring to establish these two positions, we must suppose, (as in all theoretical reasoning on these subjects) an absence of friction, of resisting medium, and of imperfection in the materials. We must also, for the sake of brevity, deal in round numbers, and precise terms, as much as possible; waiving fractional parts, and minute accuracy, where the omission does not affect the argument.

The force of gravitation is not in the least diminished by a body yielding to its impulse: for with whatever velocity one body may be falling towards another, it is attracted as strongly, when under that velocity, as if withheld from obeying it.

Therefore, the fall of bodies would be *instantaneous*, from any distance, however great, but for the *inertia* of matter, which is in all cases in the direct ratio of the attraction, (or weight.)

If a ball weighing one pound, were let fall from a height of 16 feet, it would reach the earth in one second of time. If a ball weighing 100 pounds, were to fall from the same height, it would also fall in the same time; because, the impeding quality, *inertia*, increases, as the attracting quality, *weight;* and as both are increased a hundred fold, the time of falling remains the same.

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* For the purpose of easy reference, a distinct index to these essays will be furnished, in a future number.

If the 100 pound ball were taken to such a distance from the earth, as should lessen the attracting force (or weight) to one pound, it would have lost 99 per cent of its weight, or attracting quality, and also 99 per cent of its impeding quality, *inertia*, and would therefore be in exactly the same situation, as regards the attraction of gravitation, as the first ball, weighing one pound, was, when 16 feet from the earth, and would consequently fall from this point, 16 feet, in one second of time.

Let us now suppose, that while the latter heavy ball, is at this distant point from the earth, where it only weighs one pound, that the attraction of the earth should be increased a hundred fold, the velocity of the ball's falling the 16 feet, would not be increased, or changed, because the inertia, or impeding property, would also be increased at the same rate, and therefore under every degree of gravitating force, or whatever may be the quantities of matter contained in the bodies acted upon by it, the velocity with which they will obey it, is as the rule for falling bodies near the earth, 16 feet the first second, &c.

Whether the *direction* of attraction be compounded of a number of attractions, as is generally the case, or result from one only, the effect is the same.

There is a well defined dividing line of attraction, between the sun and the earth; a body on this line would have no weight, nor any of its concomitant, inertia: if it deviated in the least from this line, (say towards the earth) it would have weight, and, but for *inertia*, its fall to the earth would be *instantaneous;* but as its weight, or the attraction of the earth, increases by its approach thereto, so does its inertia, or impeding quality; so that the body would fall from this dividing line of attraction, or from any point between it and the earth, in the usual ratio assigned to falling bodies near the earth.

Suppose an opening through the centre of the earth, from one surface to the other; here we have every degree of gravitating force, from the greatest at the surface, to nothing at the centre. If a body were let fall from one surface, I believe it will at once be admitted, that it would rise to an equal height on the other side of the centre; and it will also be admitted, that this could not take place, without a continually accelerated velocity of the body *to* the centre, notwithstanding the diminishing attraction of gravity as it approached this point, and the opposing attraction of the superincumbent matter which it had passed; and that its rise to an equal height *beyond* the centre, could not be effected, but for its inertia (in this situation called *impetus*) increasing, to prevent its stopping, as its weight increased by receding from the centre.

Suppose two balls of equal size and weight, when at the surface of the earth, to fall simultaneously, the one from the surface, and the other from a point midway between the surface and centre; this latter ball would reach the centre at the same instant, that the former reached the latter's point of departure, notwithstanding the difference of gravitating force acting on them during the fall.

Most of my readers have probably seen the experiment of bodies falling in an exhausted receiver, when the lightest particle of down, falls a given distance in the same time as a leaden bullet; and know that the *bulk* of an object, where there is no resisting medium, is no impediment to its fall: now if this leaden bullet, be supposed at such a point between the earth, and sun, as should cause it to weigh no more than the particle of down in the receiver, would it not be under the same influence of gravity, and the velocity of its fall be the same as was that of the particle of down, at the earth's surface, and in the exhausted receiver?

We speak of a body falling to the earth, and by this expression, make the body, *active*, and the earth, *passive;* it is, however, well known, that the fall, or approach, of bodies to each other, is mutual, and the respective degrees of their approach, depend on circumstances to be hereafter mentioned. But I am asked, why it should not be uniform in all cases, since I contend that a body always obeys an attraction at a uniform rate, without regard to the force of that attraction, whether in opposition, or conjunction?

If we suppose the earth, and a small body, situated a certain distance from it, to be the only bodies existing, or consider these two, as entirely free from the influence of any other bodies, *the sum of their joint approach*, (or falling together,) would be the usual rate assigned to falling bodies; for whatever might be the difference of the quantity of matter in each, the attraction to each other would be equal; (as much so as two persons having hold of different ends of a string —A, at one end cannot exert any force tending to draw B to him, without causing B to exert a like force tending to draw A to *him.*) And since the attraction of the two bodies to each other, is the only influence acting upon them, they would meet at a point equal distant from both. If we suppose *two* small bodies, instead of one, each containing equal quantities of matter, and placed in opposite directions from the earth, situated as above, then the earth would remain stationary, and both the small bodies would fall to the earth in the same time, from the same distance as the one body did, although the earth, in that case, met it half way: for the law which we assign to "falling bodies," is that, which, more properly speaking, governs "the approach of bodies to each other, by the attraction of gravitation."

The earth, and moon, and all that is in them, form a compound body, with a common centre of gravity, subservient to the sun's attraction and influence; and this common centre of gravity cannot be affected, or changed, by any changes in the parts of this compound body relatively to itself; wherefore, it follows, that when a small body falls to the earth, the earth will fall to it, only so far as preserves the common centre unaltered, and whether it be more or less, does not alter the time of their coming in contact.

A friend of mine thinks that the tides make against my theory;

"for if the waters on the earth are at all influenced by the moon's attraction, they ought to fall to it at once."

In answer, I state, that if the earth were free from the attraction of any other body, there would, of course, be no tides. If the earth were at such an immense distance from an attracting body, as should render the *difference* of attraction between the nearest and farthest side incalculable, then also there would be no tides, however great that attraction might be; for every part of the earth would be attracted alike, and as no part could approach the attracting body, without the whole, no change of shape would ensue.

In the actual state of the earth, the attraction of the sun, assimilates more to the case of the supposed attracting body, than that of the moon does; and the sun has, therefore, less influence, than the moon, in creating the tides, notwithstanding the sun's superior attracting force.

That part of the earth (or water) immediately under, or towards the moon, is not moved by its attraction, because in a direct line with the attraction of the earth; nor would it be in any way, unless the attraction of the moon became greater than that of the earth, (in however slight a degree,) in which case it (the water) would leave the earth, and fall to the moon, in the usual ratio assigned to falling bodies. But as we recede from this part of the earth, the *directions* of the earth's attraction, and that of the moon, form an angle; and the angle increases until the lines of attraction of the earth and moon are at right angles, where the moon's influence is the greatest; for the mean direction of attraction at every angle, is compounded of those of the earth and moon, and causes an alteration of the plumb line; and the greatest alteration, of course, where the lines of attraction are at the greatest angle. The water, which was before on a level, is now on an inclined plane, and flows down it, towards that part of the earth immediately under the moon, at which place the water rises, not from the moon's attraction, (*directly*,) but from the head of water flowing in from all sides. Hence, it is evident, that when the sun and moon are at right angles to each other, their power to rob each other of the water attracted by each is the greatest, and the equalizing property of this influence causes the "neap tides."

The generally received law of falling bodies, is this. All bodies will fall an equal distance in equal times, without regard to the quantities of matter contained in them; but presumes, in the application of the rule, the same gravitating force, and it is exemplified thus. If a ball weighing one pound, fall 16 feet in one second of time, a ball weighing 100 pounds, will fall the same distance, in the same time; for each pound in the heavy ball is acted upon in the same manner, and in the same degree, with the ball of one pound; and the heavy ball may be said only to represent 100 balls, of one pound each. All this is true; but a lecturer on natural philosophy would be considered as deviating from orthodox principles, if he addressed his audience to the following effect:——

"The ball which you see on the table before you, weighs one pound;

and, consequently, it is drawn towards the earth by the attraction of gravitation, with a force of one pound, which causes it to fall 16 feet, in a second of time; and if the attraction of gravitation were increased 1000 times, drawing this same identical ball towards the earth, with a force of 1000 pounds, the velocity of its fall would not be in the least accelerated, thereby." This, however, is the point for which I contend; and the contrary is either implied, or expressed in every work I have seen on the subject. In a review, (of Captain Sabine's work, to determine the figure of the earth,) by Professor Renwick, written for the "London Quarterly Journal of Science and Arts," where the principle is of vital importance to the merits of the subject, we find the following passage: "this diminution of the intensity of gravitation will affect the rate at which heavy bodies fall to the surface of the earth, and the time of the oscillations of pendulums."

It is related of Sir Isaac Newton, that the laws of gravitation, and their universal applicability to all matter, were suggested to him by the circumstance of an apple falling from a tree, which caused him to institute the inquiry, why it should fall? But it appears to me, that the circumstance might have been pursued farther, and have led to the question, why it should fall 16 feet in a second? and that not only the *fact* of the fall, but the *rate*, would have been found equally to pervade the universe; for, if I am correct in my ideas on this subject, the earth, if divested of the motion in its orbit round the sun, and, consequently, of its centrifugal force, would fall to that body, under the same law, and commence its career at the same rate, as an apple falls from a tree, viz. 16 feet the first second, &c.&c.

A pendulum is governed by the law of falling bodies, and the *inertia* is always as the *gravitating force*—for it is by the gravitating force that it falls from a given height in the arc of its vibration, to its lowest point,—and by the inertia that it rises to the same height from which it fell.

The quantity of matter contained in a pendulum, does not alter the times of its vibrations, by the law quoted as governing falling bodies.—If a pendulum of given length, (say 39 inches) and weighing ten pounds, vibrating seconds, at the surface of the earth, be supposed to be taken to a point towards the centre of the earth, where it should weigh only five pounds, (tried by a spring, or some invariable standard) its length remaining unchanged, it would still vibrate seconds; for, as regards the operation of gravitation, it would then be similarly situated to another pendulum, at the surface of the earth, of half the weight of the first.

If this view of the subject be correct, there is but little chance of gaining a difference of vibrations, by the loss of 1-259th part of the gravitating force, occasioned by that of the centrifugal force at the equator.

I find the idea which generally prevails, when considering the effect of a pendulum being subjected to an increase of gravitating force, to be the same as imagining an additional weight suspended by a thread to the *bob* of the pendulum, whereby the vibrations would be quickened, and shortened; for the suspended weight does not describe the arc of a circle, having its greatest velocity at the lowest point, and thereby enabling it to attain the height from which it fell.

The operation of a pendulum, so situated, is, however, worth examining, for each vibration is shorter, and quicker, than the preceding; and it would thus continue (in theory) to vibrate *forever*, affording a beautiful illustration of the infinite divisibility of both time and space.

The results of the experiments on the pendulum, to determine the figure of the earth, are various, and unsatisfactory, as indeed they must be, when we consider the source from whence they are derived.

I do not deny the general fact, of the vibrations of the pendulum, being slower near the equator, by the diminution of gravitating force; but it is not caused on the principles commonly supposed. The motion of a pendulum, is sustained, and the friction overcome, generally, if not universally, by the falling of a weight, in the manner of a clock weight.—Now here is a certain office to be performed, or work to be done, in a given time, which is accomplished by the falling of a certain weight in a given time, equal to the task. If a pendulum, so adjusted at London, be taken to the equator, the power (the weight) to do the work is no longer the same; and it by no means follows, that the work to be done (friction to be overcome) has decreased in the same ratio with the power to do it: therefore, from this vague, and varying cause, the vibrations will be slower.

T. W. B.

Cincinnati, 9th May, 1827.

Perkins's Steam Engine.

We have seen this engine repeatedly in action since our last notice of it, and to all appearance giving great satisfaction to those who have visited it; there has not, however, yet been exhibited any demonstration of the actual amount of power which it is capable of exerting, nor do we consider that its present situation, in Mr. Perkin's factory, is at all favourable to such an experiment. The public must, therefore, for the present, be satisfied with such inferencial proofs, of its capabilities, as may be drawn from a consideration of the amount of friction exerted upon the fly-wheel, by the weighted lever described in our former report.

We have seen a testimonial given, for some private purpose, by several respectable engineers, whose names however, we do not feel ourselves at liberty to publish, without authority. It was to this effect:

"We, the undersigned, having made ourselves practically acquainted with Perkins's high pressure, safety, steam engine, do not hesitate to state, that he has established the following new and important facts in the construction of his engine. 1st, Absolute safety. 2nd, Greater economy in fuel than in any other engine hitherto invented. 3d, The removal of all the re-action of the steam, and atmospheric air, on the eduction side of the piston, without the necessity of an air pump. 4th, A new and simple flexible metallic piston, requiring no oil, or lubrication, whatever. 5th, A reduction of three fourths of the weight and bulk, by very much simplifying certain complicated parts of steam engines, and substituting a very simple eduction valve, for the one commonly used both for eduction and induction. By which means, a reduction is made in the size of the engine; a saving of power is effected, and a diminution of friction; less wear and tear occurs, and less destructibility of materials. And lastly, the joints, by Mr. Perkins's peculiar mode of connecting, are more easily made secure, and tight, even with the steam at the pressure of 1000lbs. to the square inch, than the joint of the low pressure condensing engines."

This is all the information, that we are at present enabled to afford upon this interesting subject; the specification will not be enrolled until September, we shall then take the earliest opportunity of laying the invention before our readers, with all its details, and in the mean time, should any further information transpire, we shall not allow it to pass unnoticed.—[*Newton's Journal.*

Account of the Conflagration in the Quicksilver Mines of Idria, in 1803.*

In 1803, on the night between the 15th and 16th of March, the workmen observed a thick smoke issuing from some of the lower galleries. It ascended, and spread itself through the higher. No fire was seen, no sound of flames was heard, but it was too evident that the mine was on fire, below. Some of the workmen, with great intrepidity, endeavoured to reach the scene of the conflagration. It was in vain; they were forced to retreat from one gallery to another, flying before an enemy whom they could not discover; for the smoke, which continued to make its way upwards to the open air, was not merely so dense and suffocating, but so loaded with noxious fumes, and particles let loose from the fossils among which the flames were raging in the bowels of the earth, that no living creature could safely meet it, much less penetrate it. They were fortunate enough to save themselves above ground, and the idea was adopted of extinguishing the fire by excluding the air. All the passages were closed as near to the supposed scene of the conflagration as they could be reached. The two shafts, which lead immediately above ground, were stopped up, outside, and plastered over with clay. Five weeks the mine remained thus sealed up, but without effect. Twice, during this period, the coverings above, were removed; each time, the enemy was found more furious than before. The flames were heard raging below, with a sound at which the miner still trembles when he relates it; the smoke, burdened with mercurial, and sulphurous exhalations, rolled forth from the mouth of the pit, like streams from the jaws of Acheron. striking down every one that came within its reach. It was apprehended that the fire had attacked the upper works, and was thus threatening the final destruction of the mine. As a last resource, the director resolved to hazard the experiment of laying the mine under water. A stream was turned into the perpendicular shaft, and allowed to flow two days, and three nights. During the first day it produced no effect. In the course of the second day, whether it was that steam, generated by the meeting of the fire and water, was struggling for escape, or that an inflammable air had been produced and kindled by the glowing fossils, of a sudden, a subterraneous explosion shook the mountain with the noise and violence of an earthquake. The huts of the miners, situated near the entrance, were rent; houses farther off, but standing on the slope, or near the skirts of the hill, started from their foundations; and the panic struck inhabitants, were flying in dismay from the ruin that seemed to threaten their valley. The whole thing must have been splendid ; accidental as it was, art could go no farther in imitating nature. In the mine itself, as was afterwards found, the explosion had rent the galleries, thrown down the arched roofs, and torn up the stairs. But the victory was gained; the vapours began to diminish, and, at the end of some weeks, it was possible to venture into the mine. It cost two years to prepare an apparatus, and pump out the water. It was carried off into the Idria, and was found to contain only a small quantity of mercury, but a large proportion of vitriolic acid, and so much iron, that the bed and banks of the river were encrusted with iron ochre, throughout its whole course, from Idria, to where it falls into the Lisonzo. At the same time, every fish disappeared from the stream excepting the eel, which seems to bid defiance to every thing except actual broiling or roasting.

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* A very complete account of the Quicksilver Mines of Idria, will be found in the *Edinburgh Encyclopædia*, Art. Idria, vol. xi. p. 149. *Am. Edit.* The accompanying account of the conflagration, which is not given in that work, is taken from Russell's *Tour in Germany*, vol. ii.

Even when the galleries had been cleared of the water, it was impossible to work in them, partly from the heat which they still retained, but still more from the fumes of sublimated mercury, which produced in the miners a violent salivation, accompanied with convulsions and trembling of the limbs. To produce an almost inhuman zeal, high wages were offered to such as would venture into places reckoned the most dangerous, to explore the consequences of the disaster, and collect the quicksilver which had been deposited in large quantities in the galleries. Many purchased this additional pittance with their lives; and altogether, the atmosphere which continued for months to infect the mine, was so baneful, that it was difficult to muster a sufficient number of healthy men for ordinary operations.

[*Brewster's Journal.*

Remarks on Prof. Eaton's proposed improvement in the manufacture of Compass Needles. By a SURVEYOR.

TO PROFESSOR SILLIMAN.

THE last number of your valuable Journal contains an article entitled "Improvement* in the manufacture of Compass Needles, by Prof. Eaton," which from the importance of the subject, I was induced to read with much attention. After I had done so, however, I was somewhat surprised that the author should have denominated that, an improvement, which, at best, could be nothing more than a method of repairing a defective or damaged instrument.

It appears from Mr. Eaton's statement, that he was led to this discovery in examining a compass of fine workmanship, which had been returned to the maker as an imperfect one. A series of experiments proved that the cause of the defect, was the lodgment of a small scale of steel in the limb of the instrument. This, of course, would have an effect upon the needle, and thus destroy its accuracy.

To remedy this defect, Mr. Eaton caused the needle to be cut off $\frac{7}{10}$ of an inch from each pole, and to be armed at each extremity with brass tips; after which, we are told, the instrument was perfect. This method, seems then, to be recommended to general use, as it is said that "another important advantage which will attend tipping needles with silver, brass, &c., is that of preserving the points from rust. It has been demonstrated by conclusive experiments, that magnetism resembles electricity in acting most powerfully from the sharpest points."

I may remark, that, although it has been rendered probable, that most metallic bodies possess magnetism, the only substance in which it is strikingly, and permanently developed, is steel; and hence this is altogether employed for the construction of magnetic needles. This being the case, my objections to Mr. Eaton's proposed improvement are,

1st. That the needle possesses the weight, and, consequently, the friction of a long one, with only the magnetic power of a short one; it having been sufficiently proved, that the friction is nearly proportional to the weight of the needle.†

2d. That in the construction of magnetic needles, those are the best, in which the opposite magnetisms exist in each half, gradually increasing in intensity, from the centre to the extremities. But this is not the case, when the ends are tipped with brass, in which, if any magnetism is developed, it may be of another kind from that which exists in the steel to which it is attached. Such a needle, therefore, is liable to the objections which would apply to one having consecutive points, or which assumes polarity, in parts other than the extremities.‡

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* This title was written by the Editor.

† See Biot, and other authors on magnetism.

‡ A very convenient method of ascertaining this fact, is to detach the needle, cover it with a clean piece of paper, and then sprinkle on the paper some fine iron filings. We can then detect the number and exact position of poles of the needle.

For these reasons, I cannot but think that the method suggested by Mr. Eaton, must greatly impair the directive force of the needle, and that its adoption would be injurious, rather than beneficial; we are therefore at no loss to account for the circumstance stated by him, that the needle, when thus tipped, was not affected by magnetic ores, *real* or imaginary.

A remark or two as to the particular case which led to the use of these brass tips. If a scale of steel or iron was lodged in the plate, it is difficult to perceive how the simple shortening of the needle would completely obviate the disturbance which this might occasion. It might render the error less manifest, but could not wholly correct it.

As this subject is one of much consequence, particularly in this country, where the compass is so much employed, I will venture to add a few suggestions, which, in my opinion, will be more likely to improve the manufacture of compass needles, than the method proposed by Prof. Eaton.

A person, upon purchasing a compass, if he wishes to obtain an accurate instrument, should test every part of the plate, limb, &c. with a fine magnetized sewing needle, suspended by a fibre of silk. If this is not at all affected by passing the different parts of the plate, under it, it may be inferred that there is no point of attraction. But if it is affected, we can easily detect the exact spot in which the iron, or steel, is lodged. In the latter case, the better way is to select another instrument, and treat it in the same manner; and so on, until one shall be found, which is entirely free from objection. This rigid scrutiny might indeed increase the cost of perfect instruments, but this is of little consequence, in a matter where accuracy is all important. Above all, no principle of *justice* would warrant the *punishment* or *injury* of the needle, for a fault of the plate.

As to the best form of compass needles, there is still some dispute; Capt. Kater preferring the pierced rhombus, five inches in length, and two in breadth,—Coulomb, and others, the arrow-shaped, &c. In one thing, however, most experimenters agree, viz. that they should be pointed; as by this means the highest degree of magnetism is developed and maintained in the extremities, which is the grand desideratum in the construction of magnetic needles. How can this object be effected if these extremities consist of brass, or silver?

Finally, I imagine that it will be much easier to keep a common needle, properly pointed, and free from rust, than it will be to obtain one of equal directive power, upon the plan proposed by Professor Eaton.

A SURVEYOR.

[*Silliman's Journal.*

On Magnetising Steel by the direct White Light of the Sun. By Mr. A. BAUMGARTNER, *Professor of Natural Philosophy at Vienna.**

ON repeating, last summer, the experiments of Mrs. Somerville on magnetising iron by the influence of the coloured light of the sun, I found out a process which succeeds sooner, and more certainly, than that of M. Morichini, and of Mrs. Somerville. It has led me to this result; that a piece of steel of the size of a common knitting needle, of which one or several places are polished, and the others unpolished, being exposed to the direct white light of the sun, acquires a north pole at every place where it is polished, and a south pole at every place not polished. The following is the process.

I took a wire of English steel, the size of a common knitting needle, and heated it so as to cover it entirely with black oxide. I afterwards took off the oxide, in one or more places, by means of an oil-stone, and I finished the polish with chalk and lime-tree wood, so as to form brilliant zones, about two, or three lines long. The steel thus prepared, exposed in a place perfectly lighted by the sun, was found, after a little time, strongly magnetic in the way indicated. The time, all other things alike, appeared to depend on the intensity of the solar light; for when I concentrated the solar light on the polished zones by means of a lens, I succeeded in producing in a few minutes, a magnetism which would have required several hours, with the natural intensity of the sun.

A piece of steel polished only at one end, takes a north pole at that extremity, and a south pole at the other. If the polished place occupies the middle, the two ends take a south pole, and the middle, a north pole. If the wire is, on the contrary, polished at both ends, these take a north, and the middle, a south pole. Lastly, if the wire has several polished zones, each of them acquires boreal magnetism, and the dull zones, separating them from one another, acquire austral magnetism. In this way, any number of magnetic poles may be developed, provided the steel wire be of a length proportionate to the number of poles desired. I have thus easily obtained eight poles, on a wire eight inches long, although of unequal intensity. I have constantly found that the extreme poles were stronger than the others, and that they longer retained their magnetism. I have not been able to succeed, by the same method, in magnetising steel wire wholly covered with oxide, or perfectly polished, nor other wires having polished stripes in the direction of their length. All the results above-mentioned, remained the same, in whatever manner the wire was placed with regard to the points of the compass. Every experiment was repeated several times, without giving different results. I need not say, that, before exposing every wire to the solar action, I carefully examined whether it was magnetic, or not, and that the experiments were made with wires not magnetic.

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* From Annales de Chimie, xxxiii. 333. Nov. 1826.

On Annealing Cast Steel, so as to make it as soft as Iron.—By JACOB PERKINS, *Esq.*

WE were lately shown by an American friend, some slips of thin cast-steel, which were as soft and pliant, and as easily bent into any required shape, as though they had been tinned sheet-iron. They were of a light gray colour, perfectly free from oxidation or scales, and were still capable of hardening, on being heated and quenched in water.

On mentioning this fact to Mr. Perkins, he stated that the process was known to him, he having practised it in America with great advantage; and he had even communicated it to one intelligent engineer in this country, who had since constantly employed it.

The secret consists in inclosing the cast-steel in close cast-iron vessels, which completely exclude the external air; and in keeping them at a moderate red heat, in a proper annealing furnace, a sufficient length of time, according to the thickness of the steel; and, lastly, letting them cool very slowly.

This process is superior to the usual practice of decarbonating cast steel, and reducing it to the state of iron; which renders it necessary to restore its steely nature again, by case-hardening it, before it can be hardened as usual. [*Tech. Rep.*

On Annealing Iron and Steel Wire.—By THOMAS GILL, ESQ.

ALTHOUGH "the annealing of cast-steel in close vessels," as described to us by Mr. Perkins, and as given in the preceding article, was a new and valuable fact; yet we well knew that a similar practice had long been used, both in this country, and in France, for annealing iron, and steel wire.

The late scientific M. Nicolas Paul, of Geneva, described to us, twenty years since, the practice employed in an iron wire drawing manufactory in France, to anneal their wire; which was by enclosing the large coils, in cast-iron vessels of an annular or ring shape, open in the middle, to allow the flame of the furnace to play through them; and the section of which rings was a semi-circle, having flat cast-iron rings, as covers to the flat tops of the vessels. Ears were made around the internal, and external borders, both of the vessels and their covers, with corresponding holes in them, into which wrought-iron pins, with heads, were put, and which pins had also holes near their ends, through which iron wedges were driven, to draw the covers close to the vessels, the juncture being previously made air-tight by a luting of loam. These vessels were heated in a kind of oven-shaped furnace, having a grate of iron bars, for the fuel, and vessels, to rest upon, with doors both to the oven and ash-pit.

We also saw, about the same time, the method employed by the late Mr. John Burr, at his steel wire works, near Hales-Owen, in Shropshire. He enclosed his bundles or coils of steel wire, for needle and fish-hook making, in cast-iron vessels, with covers fitted closely to them, to exclude the air. These vessels were uniformly heated in a cylindrical furnace of brick-work, covered with a dome, and having a hole in the centre of the dome, to serve as a chimney. The furnace was strengthened by a number of projecting buttresses, which were built around it, and by iron chains surrounding the brick-work. The fire was made upon a circular grate, which ran all round the inside of the furnace, and was supported upon walls; air-holes to supply the fire being also made at regular distances through the external wall of the furnace. A door of brick-work was built up, after the coal fire had been lighted, and the vessels containing the steel-wire, had been deposited in the furnace; this of course, was taken down again after the annealing was performed, and the furnace had become sufficiently cool to remove the vessels.

In Cadell's "Journey to Carniola, Italy, and France, in the years 1817 and 1818," he says, vol. i. page 243, that in the iron wire works, near to Pistoja, in Italy, "after the wire has been drawn, it is hard; and, in order to restore its flexibility, it must be heated, and suffered to cool, gradually. For this process of annealing, large cast-iron vessels are employed, four feet high, in form of a truncated cone, with the base uppermost. The wire is put into the vessels, which are then covered and luted tight. The vessel is surrounded by a brick-wall, at some distance from its sides, and burning charcoal is put in, between the vessel, and the wall. These cast-iron vessels are made at the furnaces in the Maremma, and they are almost the only articles of cast-iron I observed in Tuscany."

In our first volume, page 423, we mentioned, that Mr. Corcoran, of Mark-lane, wire weaver, inclosed his wire in closed cast-iron vessels, *surrounded with ground flint*, and then exposed them to a red-heat, in proper furnaces. And that, although the wire thus became quite flexible and pliant, yet it was as bright as though it had not been heated at all. [*Ib.*

Remarks by the Editor.—We had been so long familiar with the foregoing process, that we had supposed it to be the universal practice in wire manufactories. The Messrs. Sellers of this city, have used it for many years; it was also followed by Messrs. White & Hazard, at their wire drawing manufactory, at the falls of Schuylkill, and by many other persons in this country; but as it may be new and useful to some persons who work in wire, we have re-published it.

On the proper Method of casting the Rims, or Felloes, and the Naves of Wheels in cast-iron, and affixing wrought-iron spokes in them.—By JACOB PERKINS, *Esq.*

IN the ordinary method of doing this, the wrought-iron spokes are laid in their places, in the sand moulds, and the melted cast-iron is poured in at the same time, both to form the rim, and the nave. The consequence of this evil practice, is, that the rim, in cooling, shrinks; and as the spokes are fixed immoveably in the nave, they cannot move inwards as they ought to do, and the rim, of course, breaks.

Now, in order to avoid this misfortune, we have only to cast the rim first, and allow it to become quite cold, whilst the spokes are at liberty to move in the mould, during the time the rim is cooling; the nave may then be cast, and the wheel will remain perfectly sound. [*Ib.*

Account of an Improved Felt Polisher for the Lathe, invented by the late Mr. Wm. Allen. By Thomas Gill, Esq.

Mr. Allen, an excellent workman in the manufacturing of ivory, and tortoise-shell, into a great variety of beautiful articles, such as tea-caddies, snuff-boxes, &c. had constant occasion to give a fine polish to his works, in finishing them. He generally employed polishers made of felt, with the finest rotten-stone and oil, as usual, for this purpose; but in those used in the lathe, and which were of a narrow cylindrical form, with their rims and peripheries covered with felt, by gluing a band of it upon them, he found great inconvenience, to arise from the gap left between the ends of the felt, occasionally receiving into it particles of gritty matters which continually arose, and caused scratches in his works, which he had great difficulty in afterwards removing. After suffering this inconvenience for years, he at length fortunately hit upon a method of *clothing his polishers with entire rings of felt*, free from the above evil, by employing *the sides of the crowns of hats* for that purpose. One hat-crown thus cut into rings, affording the material for clothing several polishers.

He had, indeed, great reason to congratulate himself upon this fortunate discovery; and when we consider how many artizans are under the continual necessity of employing similar polishers, in the finishing of their different works, we conceive that we are rendering them an essential service, in making this communication.— [*Ib.*

Notice of some Showers of Fishes, in various places in Scotland; and of Shells in Ireland.

Shower of Fishes in Argyleshire.—The rare occurrence of such falls, renders them so remarkable, as to be remembered after long intervals of time, and even after every circumstance connected with them is forgotten. When any phenomenon is not considered in its relation to any particular cause, few will attend to its possible relations to preceding events; and fewer still will esteem it of such importance, as to treasure up the observations which they might have happened to make, even although these might be of great importance, in illustrating the nature, and causes, of the circumstance observed.

It is thus, that, though the testimony of many has enabled me to ascertain, that a shower of herring-fry fell in Lorn, about the year 1796, yet I have not met with any, who could inform me of the particulars concerning it.

In the same district, and near the same place, on a small eminence above Melford House, a shower of herring fell in 1821, in every respect so large and good, that the tenants, by whom they were found, were induced to send some of them to their landlord, then residing in Edinburgh. In regard to the state of the weather, I could learn no more than that it was exceedingly boisterous; while the hill on which they were found, is exposed to the south-west wind, which blows along Loch Melford; an arm of the sea in which herrings are frequently found, and, as far as I know, the only one in this quarter, in which the fly is commonly, and successfully used in fishing for them.

In the month of March, 1817, strong gales of wind from the north, were experienced in Appin. Upon the evening of the second day of their continuance, rain fell in abundance; and, the next day being very warm and sultry, some children observed a large quantity of herring-fry, scattered over a moss, a little to the north-east of the ferry of Shien. There might have been about three barrels, or more, of these, and measuring from 1½ to 3 inches in length. Now the place in which they were found, is only about 300 yards north of Loch Creran, an arm of the sea, running east and west, from which, several persons supposed the fry must have been raised. The wind, however, being from the north, renders this a seeming impossibility; and it may, perhaps, be more safely concluded, that they must have been ejected from the Linnhe Loch, another arm of the sea, extending south-west and north-east, about three miles north of the place in which they were found. A range of moorland, about 300 feet above the level of the sea, intervenes; but it is easier to suppose the cause which originally elevated these fry, to be so powerful as to carry them this height, and distance, than that they should obtain a course contrary to the general body of the air. They exhibited no appearance of being bruised by the fall, nor was there any thing which could induce the belief that water had fallen at the same time.

Letter Rev. Colin Smith, of Appin, to the Editor.

Shower of Herrings in Galloway.—Macchirmore, or the head of the Macchirs,* for indeed there is not much white ground above it, pertains to Dunbar of Macchirmore. It is situate upon the east side of the river of Cree, one mile distant, to the south, from the town of Monnygaffe; and here is the first ford of the water of Cree, except that betwixt Kirkmabreck and Wigton, of which more hereafter.

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* Macharmor is not "the Head of the Macchirs," but the Great Machar, or level arable district. The Head of the Machars, would be Ceann-a-Mhachair [*Edit.*

This ford is five miles, or thereby, *in recta linea*, to the northward, distant from Wigton. In the moors of this parish of Monnygaffe, not many years since, at a place called La Spraig, not far distant from the water of Munnach, but sixteen miles distant from the sea, there fell a shower of herring, which were seen by creditable persons, who related the story to me. Some of the said herring, were, as I am informed, taken to the Earl of Galloway's house, and shown to him.—*Andrew Symson's Large Description of Galloway*, 1684. *Edin.* 1823, *p.* 31.

Shower of Herrings in Kinross-shire.—Mr. Arnot informs me, that, about a year ago, a shower of herrings fell near Loch Leven; it came in the direction of the Frith of Forth, and the herrings are conjectured to have been blown out of the water of the Frith, and carried by the wind across Fifeshire, to the place where they were found, in the vicinity of Loch Leven.

Shower of Shells in Ireland.—I send you another instance of a shower of shells, which fell at Monastereen, in the county of Kildare, a few days ago. At this time, the tides were remarkably high, and the sea exhibited marks of unusual disturbance. I regret that I can send one only of these shells. [*Edin. New Phil. Journ.*

Account of a new Steam, and Heated Air Engine. By Minus Ward, *Civil Engineer, Baltimore.*

Mr. Ward having recently received from Europe his patent for his new engine, wishes to lay before the public an extract from his specification, which will describe the principle of its action.

Specification of new and economical methods of using heated air, gases, elastic fluids, and products of combustion, which are available to the increase of steam power.

These consist in employing or using, in whole or in part, the air which is *heated* while passing through the fire of the furnace attached to the steam engine, together with the heated gases, elastic fluids, or products, set at liberty, or given out by the burning fuel in the same. By means of sundry appliances and machinery, which are added or affixed to the steam engine, to *force* or *throw into* the boiler, either below or above the surface of the water in the same, the aforesaid heated elastic fluids, or products of combustion, thereby causing them to mix or unite with the steam. Thus availing myself of the caloric and agents, which are ordinarily suffered to escape through the flue or chimney into the atmosphere, and are lost. This may be put into practice by an indefinite variety of methods.

One method is, to place a pneumatic forcing pump, which we will call the *gas-pump*, on the top of the boiler of the steam engine; a pipe, or tube, extends up from the furnace below, through the water and steam in the boiler, and enters the bottom of the gas-pump chamber, where there is a valve opening *upwards*. By the side of this valve, there is another valve opening *downwards*, into the cavity of the boiler. The piston of the gas-pump is driven by the engine. From the upper part of the boiler, commonly called the steam chamber, a pipe extends to the steam, or working cylinder of the engine, which cylinder is of a construction no way different from that of the steam engine in common use.

Operation.—As the piston of the gas-pump rises, the valve which opens upwards will be forced open by the laws of atmospheric pressure, causing the heated elastic fluids and products of combustion to follow the piston. The other valve being kept closed by the pressure of the steam in the boiler, the heated air, gases, and other heated products of combustion, rise from the burning fuel in the furnace, and passing up through the pipe and the valve, fill the chamber of the gas-pump; the cubic contents of which may be to those of the steam, or working cylinder, as 169 to 256, or thereabout. On the descent of the piston, the inlet valve closes, and as soon as the descent of the piston, by compressing the heated air, gases, and other heated products of combustion contained in it, causes their elastic force to become greater than the elastic force of the steam in the boiler, the valve in the boiler opens, and the contents of the gas-pump are driven into the boiler, at a temperature nearly equal to what it was in the furnace; where, coming to an actual contact, and mixing with the steam, they give out a portion of their caloric to the steam, and the temperature of the mixture, will be higher than was that of the steam, before the injection of said gases. The increased temperature, will cause a corresponding increase of the elastic force; the mixture of steam and other heated elastic fluids thus formed, passes on to the working cylinder of the engine, where, after acting by their pressure upon the piston of that cylinder, they are either suffered to escape into the atmosphere, or they are conveyed to a condenser, where the steam and aqueous parts of the mixture are condensed, in the same manner as steam in condensing engines. The water thus formed, the injected water, with the air, gases, &c. are pumped out together. The above arrangement of parts has been specified on account of the ease with which it may be understood.

Another modification, is to immerse the gas-pump in the boiler with its upper flange upon the top of the boiler. A tube, open at both ends, extends from near the upper part of the steam chamber, internally down along the side of the gas-pump, and enters the bottom of the same. By this arrangement, as the piston of the gas-pump rises, the chamber below the piston will be filled with steam, and as no valves are placed in this tube on the ascent of the piston, this steam will be returned into the steam chamber; the use of this is to keep the packing of the gas-pump continually damp, so as to prevent its being burned. The inlet and outlet valves are placed upon the top of the pump, the piston rod working through a stuffing box; a tube extends from the furnace, to the inlet valve, and another tube extends from the outlet valve, to the steam chamber. The gas-pump may be also placed, externally, on the end, or side of the boiler, and be a double acting pump, with a pair of valves, as before described, at each end thereof. In this plan, an elastic metallic piston may be adopted; one method of making which, is to substitute for the packing of hemp, a packing, or gasket of card-wire, which is applied in the same manner as the packing of hemp.

In the above methods, if it be intended to take into the gas-pump, a larger part, or the whole of the heated elastic fluids, and products of combustion, a damper, or valve, may be placed in the flue or chimney, above the tube leading to the gas-pump; which damper, after the engine is in operation, may be totally, or partially closed. If it be entirely closed, the draught and the consumption of the fuel in the furnace will be in proportion to the capacity of the gas-pump, and the number of strokes made by its piston in a given time.

On the Preservation of Zoological Specimens, from the depredations of Insects. By Thomas S. Trail, M. D. F. R. S. E. &c.* *Communicated by the Author.*

The difficulty of preserving zoological specimens, from the depredations of insects, is a subject of regret and anxiety to every collector; and various methods have been proposed of accomplishing this desirable object. The compositions into which *arsenic* and *corrosive sublimate of mercury* enter, are well known to be very effectual, when properly applied; but, unless used with caution, they are apt to injure the natural pliancy of the skins, and they can scarcely be effectually employed to protect collections of insects. I have known these substances, even in the hands of the most expert, produce such tenderness of the skins impregnated with them, as to form a considerable obstacle to the *setting up* of specimens. To render them effectual, too, they must be carefully applied to each specimen; by which the labour of collecting, and preserving, is considerably increased.

Every substance which I have yet tried, seems to be inferior in efficacy, and ease of application, to the following,—the method of Mr. William Gibson, preparer of objects of Natural History, residing in No. 16, London Road, Liverpool; which I shall transcribe from his own communication to me.

"I have found" says he, "that nothing destroys insects so effectually as *rectified oil of turpentine*, and my method of using it, is as follows: I put the turpentine in a bladder, the mouth of which is firmly tied with a waxed string; and nothing more is necessary, than to place the bladder, thus prepared, in the box with the birds, or to tie it to the pedestal, on which the birds are perched, in a case. If there be any maggots on the birds, I have invariably found, that they will soon be dislodged from the feathers, fall to the bottom of the case, and die in the course of two days. I have also made the experiment of introducing the common house-fly, the large blue-bottle fly, and moths, into a case of birds, so defended, through a small hole in the bottom of the case. The moment the flies enter the box, they begin to vomit a whitish, glutinous matter; they are much agitated, and the largest of them die in seven minutes. I have, in like manner, repeatedly introduced active American cock-roaches, and these strong insects soon became uneasy, often rubbed their sides with their hind-feet, and died in about an hour and a half. I next got a bird skin full of living maggots, and placed it in my defended case; in about three hours they were seen *coming out* in all directions, and fell to the bottom of the case, where they died. For large cases of birds, a pig's or a sheep's bladder is sufficient; for middle-sized cases, a lamb's or a rabbit's bladder will do; and for small ones, we may use a rat's bladder. The turpentine evidently penetrates through the bladder, as it fills the case with its strong smell."

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* The method of preserving zoological specimens by Dr. Trail, we have been in the practice of employing to great extent, and most successfully, in the Museum of the University, for a considerable time past.—*Editor.*

The powerful anthelmintic effect of oil of turpentine, corroborates Mr. Gibson's account of its poisonous quality to the larvæ of insects; and its instantaneously killing perfect insects, must be familiar to the entomologist. I may here remark, that I have found the common receipt of dipping the pin, with which the insect is to be transfixed, in aquafortis, is by no means so speedy a method of putting an end to its sufferings, as applying a single drop of turpentine to the corselet. Though disappointed in the use of the pin dipped in acid, I never found the largest insects, *Libellulæ*, *Scarabæi*, *Blattæ*, or *Scolopendræ*, that could, for a moment, resist the application of the oil of turpentine.* I ought to add, however, that my entomological pursuits have been but few; for the difficulty of speedily killing insects, without injuring the specimens, early gave me a distaste to that branch of Natural History.

The difficulty of destroying the minute white *acari*, that infest the hairs of specimens in collections, is well known. On the neck of a large specimen of *Phoca leonina* (Linn.), in our Museum, I lately observed innumerable *acari*. I directed the skin to be carefully washed with a strong solution of corrosive sublimate, in spirits, seemingly without much effect. Some of them even crawled among the hairs, while still wet with this solution; but on brushing the part infested by these vermin, with oil of turpentine, they speedily disappeared. [*Edinburgh Journal.*

Notice regarding Steatite or Soap-stone, and its principal uses.

STEATITE is, as is well known, a variety of the talc genus. Its colour is white, green, or gray; it is also sometimes, though rarely, red and yellow. Its specific gravity varies from 2.60. to 266. It is a compound of silica alumina, magnesia, oxide of iron, and water, which vary according to the locality. It is very common in Cornwall and Germany. As it is fusible only at an exceedingly high temperature, and is easily wrought, excellent crucibles may be made of it, which are further hardened by fire, and which are only with great difficulty penetrated by litharge. It is also employed in making moulds for casting metals. In England it is used in the manufacture of porcelain. M. Vilcot, an artist of Liege, made several trials of it, with the view of finding out whether it might not be susceptible of being employed by the lapidaries. He prepared cameos of this substance, the colour of which he brightened in the fire, and which he rendered so hard, by the elevation of the temperature, as to give sparks with steel. They were then coloured, yellow, gray, or milk-white, by different solutions. He polished them upon the stone, and ended with making them assume all the lustre of agate. Some pieces even resembled onyx, in colour; but a serious inconvenience was, that the markings were easily altered by the fire, and could no longer be restored. Steatite has a great affinity for glass; it is also employed, in the manner of paste, reduced to a fine powder, and mixed with colouring matters, for painting upon this substance.

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* I have seen several coleopterous insects, swimming about for some time in strong spirits; but immersion in oil of turpentine was uniformly and speedily fatal.

It also serves as a sympathetic crayon for writing upon glass; the traces seem effaced, when a piece of woollen is passed over them, but they re-appear immediately, when moistened by the breath, and again disappear when the glass becomes dry. Steatite is not so easily effaced as chalk, and does not, like that substance, change its colours. Tailors and embroiderers also, prefer it to chalk, for marking silk. It possesses the property of uniting with oils and fat bodies, and enters into the composition of the greater number of balls which are employed for cleaning silks and woollen cloths; it also forms the basis of some preparations of paint. It is employed also for giving lustre to marble, serpentine and gypseous stones. Mixed with oil, it is used to polish mirrors of metal and crystal. When leather, recently prepared, is sprinkled with steatite, to give it colour, and afterwards, when the whole is dry, it is rubbed several times with a piece of horn, the leather assumes a very beautiful polish. Steatite is also used in the preparation of glazed paper; it is reduced to a very fine powder, and spread out upon the paper; or, it is better to mix it previously, with the colouring matter. The glaze is then given to the paper with a hard brush. It facilitates the action of screws, and from its unctuosity, may be employed with much advantage, for diminishing the friction of the parts of machines which are made of metal. [*Ib.*

Notice of a new application of metals as a coating for Iron, Steel, Copper, &c. And also, of a new Gold coloured metal, manufactured in Italy. Extracted from a letter written by Thomas Appleton, Esq. American Consul at Leghorn, to James Mease, M. D. of this city.

"A FRIEND of mine has invented a metallic alloy, which is applied with ease, and at little expense, to all kinds of iron work, and which effectually protects it, for ever, from rust; it amalgamates with the iron, penetrating it to some depth. The colour approaches to that of plated ware. Wherever there are defects in the iron, from the presence of earthy particles, or other causes, the application will not seize on such parts, but forms a perfect covering wherever the metal is sound, from which it never separates. The invention has been approved by the academies of Paris, Turin, Milan, Rome, and Bologna, where the inventor has obtained patents. I have pieces of iron, which have been buried in the earth for several months, without any other effect than the tarnishing the surface in a slight degree, and which is readily removed by rubbing with fine sand and water. It forms a beautiful covering for iron bedsteads, rails, or gates, and indeed almost every kind of iron work."

"A company is formed at Bologna, with a capital of 100,000 dollars, for coating iron work; and they are now drawing out plates, to form, if I may so say, a new species of tin plate, very superior to the old kind; for the metallic application adheres so firmly, that the work when broken, may be re-heated, and joined as easily as any other iron, without injury to the coating, which is not the case with tin. I send you a printed prospectus from the manufactory; and in order that you may have a more perfect conception of the thing, I send you two iron bedsteads, highly filed, and covered with the composition. I purchased them for this express purpose; the price, at the manufactory, is fifty dollars each, with their pillars, ornaments, &c."

"The inventor sends you, as a further sample of his coated iron, a little sofa, about 18 inches in length. It is the exact model of one sent to our Grand Duke, a few days ago."

"Four ounces of metallic composition, is sufficient for covering a bedstead; twelve ounces are valued at about a dollar and fifty cents. My pen-knife, and scissors, are covered with it, and their edges in no wise injured."

"I now call your attention to another invention of the same individual, not, perhaps, so essentially useful, but nevertheless, very beautiful and ornamental. This is a yellow metal, so perfectly resembling pure gold, that my snuff box, which is made of it, has certainly never been suspected to be other than the purest gold; it is of the same weight, within a fraction, and answers on the touchstone, to gold of 18 carats—it can be made like that of 24. This metal also is included in the manufactory at Bologna. They make there metal buttons, which are as beautiful as those most highly gilt, when new; but they have this preference, that they are eternal, and may be left in your will to your children's children, as they are made of the solid metal, of the same colour throughout. Gilt buttons, you well know, lose their covering of gold, and leave a disgusting disc of brass, before the coat is half worn out. This is strikingly the case with the buttons of our naval officers. Those of the new manufactory, may be purchased at 50 cents per dozen. Such a manufactory would be of essential importance in the United States; and very beneficial to any manufacturer who should procure the art of compounding the metal. The inventor sells it to the manufactory at Bologna, at two dollars and sixty cents, for the pound of 12 ounces, which quantity will make 9 dozen of coat buttons. But it is not confined to the making of these, but is used for watch cases, and every sort of ornament to which gold is applicable; I have in use, desert knives and forks, and fruit and coffee spoons, which are truly beautiful. This metal, the inventor calls ARTIMOMANTICO, as you will see by the prospectus."

"In order that you may see, and believe, I send you three desert sets of this metal, in all 144 pieces; they cost here 40 dollars the set."

"The inventor, who is my particular friend, informs me that he would sell the art, which is possessed by no one but himself; the ingredients, he says, are simple, and found in every country. To me, it appears a thing of great importance, and should any of my countrymen wish to embark in it, I would lend all the aid in my power."

The prospectus which accompanied the foregoing account, adds but little to the information contained in the letter; we will however, make one extract, which is as follows:

"This application is a kind of mixture, resulting from the union of many metals, and which possesses the important property of refusing to unite with oxygen at common temperatures, or even when artificially heated. It does not increase the thickness of the article to which it is applied, for whilst it incorporates with the whole surface, it does not cover the marks of the finest file, or in the slightest degree efface letters, or other marks. It does no injury to the temper of knives, nor can it be distinguished by the touch, on a piece of metal, to one half of which it has been applied."

We have examined the bedsteads, and the articles of imitation gold, which have arrived in this city; the former are deposited in the cabinet ware room of Cook and Parkin, Walnut, between Third and Dock streets, and the latter at Lewis Veron & Co.'s store, Chesnut near Third street, where they may be seen.

With respect to the material with which the iron is coated, it appears to us to be an alloy similar to some of the compositions of hard pewter, and we think, that it would require but few trials, to enable some of our intelligent workmen to imitate it perfectly.

The articles of *Artimomantico*, or gold coloured metal, are not fashioned to the taste of this country, but the object in sending them, was principally to show the colour and texture of the composition. The greatest objection to it, appears to us to be its softness, as we found that it would bend from the application of a very slight force

This alloy, it appears, was patented in France, in the year 1814, the patent there, must therefore nearly, or quite have expired, and the process have become public property; and of course, should the alloy, upon thorough investigation be found valuable, its composition may be known. We have seen many articles of gold coloured metals, both from France and England, quite equal in appearance to that in question, and superior in hardness; they however usually tarnish readily, and should the Italian compound be as free from this defect, as the account of it declares it to be, its superiority will depend upon this property.

Improved Brick-Kilns.

Mr. S. R. Bakewell of Wellsburg, Virginia, has made an improvement in the manner of constructing Brick-kilns, which, from the testimonials in its favour, appears to be of considerable value.

This plan has been put into operation in Baltimore, by the Messrs. Berry, and by Mr. George Warner, experienced brick-makers, who have given certificates in its favour: the former gentlemen say, "that its merits equal, if not surpass their most sanguine expectations, and they are of opinion, that in such kilns, there will be a saving of time, fuel, and labour; *that both ends can be settled simultaneously, with as much ease as if they were fired separately.*" Mr. Warner, after observing that his experience in this business, has been for a period exceeding forty years, says, "that in the use of those kilns, by persons tolerably well skilled in the art of burning bricks, there will be a saving of time, fuel, and labour; that the burning of the bricks can be more certainly and easily conducted in windy weather, than in kilns of the common construction, as it appears that the heat, or fire, is entirely within the control and management of the burner, which is not the case on the old plan."

The following letter exhibits the views of the inventor, on the subject.

Dr. Jones,

Sir,—A short time ago I forwarded you copies of certificates, which I received from John and Thomas L. Berry, and from George Warner, Esqs. in behalf of my newly invented Brick-kiln. In this communication, I have taken the liberty to fill the deficiency, which appeared in their cautious and prudent statements, as to the precise amount of saving, or advantage which these kilns possess over the old ones, and although the kiln has been fired twice since those certificates were written, and both equally as satisfactory as the first, yet circumstances over which I had no control have concurred, to prevent me from proving to a demonstration the statements that follow. However, I will, in lieu thereof, give you as correct an opinion, as at present is in my power; and in the first place, I will assert with confidence, that I am well and perfectly assured, that by adopting these kilns, the gain in time and labour will be fully one third each; and in fuel, I am also equally certain (and will insure the purchaser of a patent right) a saving of one quarter of this essential, and in many places, expensive article; but it is my sincere and candid opinion, that after a little practice, the saving will be at least one third of the quantity made use of, or wasted, on the present plan; but the most important advantage that will arise from the use of these kilns, will be, by the increase in the quantity of the first quality brick, for instead of obtaining only about one third, or at most one half, of hard red ones, (fit for paving) from each kiln, as at present, experienced, and judicious firemen, such as the gentlemen before named, and many others, with whom I am acquainted, can, and will, soon augment the quantity of such, to nearly the whole contents of a kiln, excepting perhaps a loss only of from 1 to 2½ per cent, including blue, black, salmon, and shattered ones; and as I feel perfectly conscious that this statement is not exaggerated, you are at liberty to publish either all, or a part of it in your valuable miscellany, should you think proper so to do.

I am, sir, your obedient humble servant,

S. R. Bakewell.

12th June, 1827.

Notice respecting the preceding and similar communications.

We will observe, that although it is one part of the design of this Journal to make known new inventions, discoveries, and improvements, it is principally intended to describe the mode by which any valuable end is attained; and that it will be expected from those persons who use our pages to announce their improvements, that they give, at once, such a description, as will make the thing clearly understood, or an assurance that it will be furnished at an early period. Where this is not intended, the announcement becomes a mere advertisement, and ought to be placed upon the cover. Where patents have been obtained, a copy, or abstract, of the specification, will answer our purpose.

ESSAYS ON LITHOGRAPHY.—No. I.

We have, in several instances, published individual processes, in the beautiful and important art of lithography; an art in which considerable progress has been made in the United States, but more particularly in Boston and New York, and we are informed that a lithographical press will soon be established in this city; an event, which for our own sakes, we shall hail with no small degree of pleasure, as it will afford to our work, greater facilities of illustration and embellishment, than those now at our command, and of which we shall gladly avail ourselves. We now commence a series of essays, which are intended to combine all the essential information which has been published upon this subject; we begin with an article on the kind of stones employed, and on the mode of polishing them, which we have translated from the last number of the *Journal des Connaissances Usuelles*, published in Paris by count M. C. De Lasteyrie, (son-in-law to Lafayette,) who has an extensive lithographic establishment, which is esteemed the second in that city.

On the Stones used in Lithography.

It is necessary to remark, that a lithographic establishment should be provided with stones of all dimensions, in order to enable it to execute work of all kinds. To the amateur, who has only one particular design, and who is satisfied with the lever press, of which we have given a description,* only a small number of stones is necessary. Two or three may suffice for him, who confines himself to experiments, or to one particular subject.

The country adjacent to that wherein lithography originated, is found abundantly provided with stones, suited to this art. There are immense quarries of it disposed in layers, along the Danube, in the country of Pappenheim, and in several other spots. The principal quarries wrought, are at a village called Solenhofen. Every one admitting the existence of a First cause, must believe, that Providence, who destined to this age the invention of an art favourable to the progress of civilization, had formed a considerable mass of stones, ready prepared for the service of lithography. They are in fact, found disposed in layers of one, two, three or more inches in thickness, in such a manner that it is merely necessary to cut them into convenient sizes, and to raise them from the quarries; their thickness being equal in all their strata. Nature, which knows neither privilege, or monopoly, has distributed the same benefit amongst other countries, though in a way less striking. Lithographic stones are found in France, Italy, Prussia, Spain, and in the United States. Researches made with greater care, would undoubtedly discover them in a greater number of places. France might do very well without stones from Solenhofen. The quarries discovered in the departments of the Indre, and in that of the Ain, and even in some other places, are sufficient for our necessities. All the lithographers of Paris make use, however, almost exclusively of those from Germany. The reason of this, is, that our quarries have been badly worked, either from want of funds, or from ignorance. The first masses which presented themselves, on the superficial strata, have been employed; these stones have been full of hollows, of veins, or other defects, though otherwise of a good quality: being harder than those of Solenhofen they are excellent for writings, for drawings in ink, and for line engravings. Those of the first quality, from Germany, are preferred for designs in crayon; those found in commerce, are not all equally good. The following are the properties which denote the goodness of a lithographic stone.

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* Of this, a drawing and description will be hereafter given.

White stones are generally inferior to the other kinds, being less durable. Those of a yellowish, or rather a grayish tint, are to be preferred, on account of their durability, and because their grain is, generally, most equal. Those which are covered with points, or little whitish parts, resembling vermicelli, ought to be altogether rejected, especially when it is necessary to make delicate drawings in crayons; as the marblings, or shades of different colours, deceive the eye of the artist, and prevent his giving to his work, that effect, and harmony, which it ought to have. The strata with stripes of a more transparent tint than the general mass of the stone, ought to be rejected, not only because they are liable to split, but because they more readily take the ink in those parts, and leave the traces of it more strong, upon the designs. Stones, however, are met with, which have fine lines, or threads of a brownish hue, which do not present any impediment to the success of the artist.

Stones which are hard, and homogeneous, acquire a more equal surface, and are better adapted to the harmony of the tints; they give a greater number of impressions, without clogging, and furnish proofs more clear and more brilliant; whilst the contrary is the case with those which are softer: the durability of a stone may be ascertained by scratching it with the point of a knife. Those which are soft, retain with more difficulty the traces of the design in the light touches: they clog more readily, and, consequently, afford a smaller number of impressions. The metallic pen cuts them easily, which produces a clogging and prevents the ink from flowing. The grain of these stones is always coarse and unequal. Those which have holes, or those which are unequal in their grain, or in their hardness, present the same inconveniences; they check the pen on the point, when employed in imitating line engraving, and do not admit of the artist giving clearness and neatness to his work. The soft parts being more easily acted on by the acid, are corroded, and injure the parts of the design with which they have been covered. Stones which have any defect whatever, ought never to be used for the crayon, with which it is necessary to draw with particular care; they are generally used for works in ink. The thickness of stones is immaterial, provided they are not too thin; for in this case, there is a risk of breaking them in the operation of printing. Their thickness ought to be proportioned to their surface The smallest should not be less than about an inch; when thicker, they have the advantage of serving for a considerable number of designs, but they are very inconvenient when it is desired to remove, or to export them. It sometimes happens, that a stone, the surface of which presents all the qualities which have just been spoken of, and which has succeeded well in the impression of one or more copies, is found to be bad in the succeeding impressions.

The stones proper for lithography are composed of lime, of argil, and of silex. The first of these substances predominates, the third is found in very small quantities. A stone entirely calcareous, does not answer for lithography, as has been proved by the marble of Carrara; crayon, and ink, adhere to this stone with difficulty, and are readily effaced from it; the lines and the shades in a great measure disappear. One of the most certain indications of lithographical properties, is the conchoidal fracture, or that kind of form presented by the fractures of the stone, when broken by the blow of a hammer, which resembles that of a shell. All stones of this kind will be found good, if they are also hard, have all the fineness of grain, and homogeneousness of texture which are necessary.

Of Polishing the Stones.

Polishing is an operation, by means of which, a uniform and flat surface, and a polish more or less high is given to a stone, according to the different kind of design, or of work for which it is intended. The care and precision with which this first preparation of the stone is effected, are not of less importance to the execution of the design, than to that of the impression. A stone, the grain of which is unsuitable for crayons, will not allow the artist to regulate his tints and to give them harmony; when he works in ink, or with the dry point, he will meet with other obstacles, if the polish of the stone be not perfect; and in each case, his drawings will be defective; but they will be much more so, if in the surface of the stone there are undulations, hollows, stripes, &c.

Stones are polished with sand, by rubbing them one on the other. The best sand for this purpose, is that quartoze sand which is fine, and hard-grained. In Paris, they, in general, make use of a yellow sand which though fine, requires to be sifted. It is necessary to be very careful that the sand which is used be not mixed with gravel, or any sharp angular substance which would form stripes on the stone, the hollows of which would not receive the printing ink, and there would, consequently, be white marks on the impressions. This serious evil is avoided by sifting the sand before it is used, and by rubbing the upper stone slowly, at the commencement of the operation, and occasionally turning it round, upon the lower stone.

The kind of design for which a stone is intended, determines the kind of polish which should be given to it. A work in which crayons are used, cannot be executed unless the stone have a grain left upon it; all other kinds of drawing, require surfaces which have the polish of marble. Whether we wish to employ a fresh stone, or to renew one which has already been used, it must equally undergo the process of polishing. For this purpose it is placed on a table, in the manner to be hereafter described; a little sand is very equally sifted over it, which is moistened with a very little water. On the first stone, is placed a second, as nearly as possible, of the same dimensions, and the upper one is rubbed about, in a direction nearly circular, but drawing it successively towards the four corners, and continually changing the relative position of the stones, so that every part of their surfaces may be subjected to an equal degree of friction. If this be neglected, and the stones be pressed on each other, and the circular motion be always the same, hollows will be formed, and uneven surfaces produced, and these irregularities will show themselves in the impressions. It is easy to ascertain by means of a straight edge, whether the stone be well levelled.

At first the motion should be slow, and the pressure trifling; the rapidity of the one, and the force of the other, increasing as the sand becomes equally distributed. When the sand becomes reduced to a paste, it no longer acts upon the stone; fresh sand must, therefore, be taken until the stone be perfectly smooth, and there no longer remain on it the traces of any former design. The ink which formed this design may have been made to disappear, without our having removed the source of its reproduction. This cause exists in the particles of the fatty substance of the crayon, or of the ink, which have penetrated below the surface of the stone, and which, being again brought in contact with the printing ink, will retain it, and reproduce parts of the old design. It may be known that this cause exists, when it is perceived that on the *wet* stone, there are light traces of the former drawing. It is then necessary to continue the rubbing until these have entirely disappeared. The aqua-fortis employed in the preparation, will, by itself, produce this effect when the traces are very superficial. It should be remarked that of two stones of the same size, the lower becomes polished sooner than the upper one. To avoid this, it is only necessary to change their position.

In order to produce on a stone intended for a drawing in crayons, the grain which it ought to have, it is necessary, after having treated it as we have just described, to sprinkle and rub it again with fine sand, which by the friction which it produces may be made to give the desired grain. When it is wished to obtain a coarse grain, the stone is rubbed for a less space of time, with the sand, this being also renewed more frequently; but, the rubbing with the same sand is prolonged, when a very fine surface is desired. This rubbing, however, should not be continued too long, or the grain which has been produced, will be destroyed. The state of the grain may be judged of by blowing briskly on the surface of the stone, on which has been placed a little clean water, and then examining its plane, by looking at it in an oblique direction.

When stones intended for drawings in ink, or with other materials, fit for lithography, are to have a very high polish given to them, the procedure is the same as that we have just described, excepting only, that after having produced a fine grain on the surface, the rubbing is continued with the same sand, reduced to a thin paste, taking care to wet the stones when the adhesion between them, becomes so great as to prevent their moving freely. The workman, when he discontinues his labour, should not leave the stones in this state, as they would adhere, and could then be separated only by steeping them in a vessel full of water.

The stones having acquired by the operation described, a certain degree of polish, are well washed, in order to remove the grains of sand, which might produce scratches; a fine polish is then to be given to them by means of pumice-stone. This polishing is effected on one stone at a time, by rubbing it, with a large piece of pumice-stone, after it has been slightly moistened. The rubbing should be in a straight line, sometimes in one direction, and sometimes in the opposite, passing successively over all parts of the surface of the stone. By thus rubbing with the pumice-stone, and the white paste which it produces, only adding water enough to preserve a slight degree of moisture, the beautiful polish of marble is produced. It is afterwards necessary to wash the stone in a considerable quantity of water, rubbing it with the hand, or with a cloth entirely free from grease, and thus to remove any particles of matter, which, by their position on the surface of the stone, would present a substance intermediate between that surface, and the drawing, which would prevent the adhesion of the latter.

Three kinds of grain may be given to stones; the coarse, the middling, and the fine. The first produces designs, the proofs of which have not the finish, and the delicacy, of those which are obtained on the two others. The second ought, in every case, to be preferred; for it possesses all the properties requisite for beauty of execution, although the proofs which it produces have not an appearance quite so soft, and mellow, as those from stones with the finest grain. But these last have the great disadvantage of soon losing the delicacy of the design; of clogging readily; and, consequently, of affording much fewer proofs. In every case it is necessary that the grain should be smooth and uniform, over the whole surface of the stone. Otherwise, the lines traced by the crayon, will be found nearer to each other, or more strongly marked in some places, than in others; the proofs, in reproducing the same defects, will be found without harmony, and without effect.

When it is intended to execute very beautiful designs, it is necessary to reject the stones which are too soft; those which have hollows; those whose texture is softer in particular spots, than in the general mass; those which are not of an equal thickness, and which have inequalities in their upper or under surface; those, in short, which are not of a good texture, and well polished.

A last precaution, is to preserve the grained, or polished stones, under cover, to protect them from the air and the dust; and not to touch them with the hand, or any greasy substance, on that side which is to be worked on. They are preserved by wrapping them up carefully, in an envelope of white paper.

Specification of a Patent granted to THOMAS LOUD, JUN. *of the firm of Loud & Brothers, of the city of Philadelphia, manufacturers of Piano Fortes, for an improvement in the Horizontal Piano Forte.*

To all to whom these presents shall come be it known, that I, Thomas Loud, Jun. have invented a new and useful improvement in the Horizontal Piano Forte, whereby the tone is greatly improved, the instrument is less subject to get out of tune, and the strings are less liable to break; for which invention and improvement I claim a Patent, according to the laws of the United States.

And I, the said Thomas Loud, Jun. do hereby declare, that the nature of my said invention and improvement, and the manner in which the same may be carried into effect, are fully made known, in the following description or specification.

In the Horizontal Piano Fortes, heretofore made, that part which is technically denominated the *action* is placed below the strings, and the hammers are made to strike upwards, in a direction contrary to that of the support given to the strings by the bridges. In my improved Piano Fortes, I, in general, intend to place the action above the strings, and to cause the hammer to strike downwards, the strings being supported upon bridges in the ordinary way. Sometimes, however, I intend to place the bridges above the strings, attaching them to sufficient supports of wood, or metal, and to place the action below the strings, in the way heretofore practised.

But what I particularly claim as my invention and improvement, is the causing the hammer to strike the strings of horizontal Piano Fortes, in such a way that the direct action of the blow upon the strings, is sustained, and resisted, by the bridges, in consequence of their being situated on the side opposite to the hammers.

Messrs. Loud & Brothers have just completed a Piano Forte, on the plan indicated in their specification, which we have examined, in conjunction with some other persons, well able to judge of the tone, and other qualities of the instrument. It has been a desideratum to give to the Horizontal Piano Forte, the roundness, firmness, and clearness of tone, which distinguishes the best cabinet instruments;

this bell-like, or glassy, effect, is produced in a very high degree by the arrangement adopted by the Messrs. Loud. The action in this Piano is below the strings, as is usual in those of a similar form; but the bridge, or support, is inverted, being placed above the strings; this arrangement possesses the advantage of greater simplicity in the action, than is possible in the other method proposed by the patentees, that is, the placing the action above, and the bridges, or supports, below the strings. We are convinced, however, that in this latter mode, the frequent breaking of the strings will be prevented, and that the instrument will stand much longer in tune than any other of the horizontal kind; our reason for this conviction is that the effect of the blow of the hammer, in its tendency to break or lengthen the strings, will be counteracted by the supports, or bridges, on their opposite sides. EDITOR.

On the Strength of American manufactured Gun Powder.

A NEAT duodecimo volume, entitled "THE AMERICAN SHOOTER'S MANUAL. *By a Gentleman of Philadelphia County*," has just issued from the press of Carey, Lea & Carey. We know but little, experimentally, of "the dog and gun," but have no doubt that the Manual will be a very acceptable auxiliary to those who are fond of the sports of the field, as it is specially adapted to this pursuit in our own country. The plates do great credit to the artists; they are characteristic, and well executed. We did not, however, sit down to write a Review, but merely to make an extract from that portion of the book, which treats of Gunpowder, as it evinces the superiority of that made in our own neighbourhood.

" *Gunpowder.*

"Powder to be good, should be quick, strong, free from impurity, and not liable to attract moisture from the atmosphere. The general method of trying the purity of powder, is by burning it on clean white paper; two or three small heaps are made, near each other, and one of them is fired; if the smoke rises perpendicularly, and there be no feculent matter left on the paper, nor the other heaps fired, it is considered as evidence that the ingredients have been of a good quality, and well compounded. If, however, the other heaps are fired, the paper burnt, or a dirty residuum left, it may be supposed, that the nitre was impure, that the charcoal was not completely pulverized, or the whole of them, were not well incorporated together. It is remarkable, that powder will vary in its proof at different times of the day, and from what cause, we know not, in truth, notwithstanding it has been in use for four hundred years, we are still but partially acquainted with the nature and properties of this article.

"Several methods of proving, or trying the strength of powder, have been adopted, but with the exception perhaps, of Mr. Dupont's Eprovette, none of them can be relied on for much accuracy, when used for fine powder.—The mortar is very uncertain, and the spring Eprovette is worse than useless, and should be abolished.

"I shall conclude this subject, by inserting a communication, made by Captain Thomas J. Baird, of the U. S. Army, on ordnance duty; in which a detail of a number of experiments, on powder from different manufactories, were kindly made by him, at my request. I was well aware, that many partialities existed, in favour of foreign powder, and prejudice was against our own; it was therefore considered adviseable to have a fair and impartial trial given to both, by some person, whose profession and character, would silence every suspicion of unfairness, or partiality; and the public may rest assured, that the following is a true and honest report of every result."

"ARSENAL, FRANKFORD, APRIL 24, 1827.

"*To the Author of the "American Shooter's Manual.*"

"MY DEAR SIR—

"It is with much pride and satisfaction I communicate to you, the result of a series of experiments, made upon several samples of powder with which you furnished me, for that purpose, together with that manufactured by Messrs. Dupont de Nemours & Co. of Brandywine.

"I say that I am proud to communicate these results, not only because they fully prove, that *our* powder is the best in the world, but they enable me to do justice to the manufacturers; who from their care and enterprise, have not only been able to compete with, but have actually, in a few years, outdone all Europe, in this important article. This is a pretty bold assertion, but it is nevertheless true.

"I speak without prejudice, and although I have invariably given the preference to domestic articles, when of as good a quality, and at as reasonable prices as foreign, still I have never boasted of so much patriotism, as to give a high price for an inferior article, because made at home.

"There is certainly no nation in the world, whose manufactures, in general, have so justly become celebrated, as Great Britain, and in no article, perhaps, more than in gunpowder.—The French powder has been highly spoken of, but by experiments made upon what is called "*King's Powder*," made expressly for the King of France and his court, and which is doubtless the best made in France, it has been found not to bear comparison with that of Pegou, Andrews & Wilkes, which is no doubt the best foreign powder ever introduced into this country.

"The annexed table, will show the result of the experiments, which were made upon an improved Eprovette, for the proof of fine sporting powder. This Eprovette, is nothing more than a small chamber capable of containing about the charge for a patent breech fowling piece, placed in a vertical position; so, that the action of the powder, is upwards: when loaded, a weight of about four pounds, attached to a lever, is let down so as to cover the chamber. To the moveable end of the lever, a graduated riband is so attached, that when explosion takes place, the weight is thrown up, taking with it the riband, which passes through a small slide; the weight, of course, again falls to its place, but the riband is held by the slide, at the point to which the force of the powder carried the weight.

TABLE.

DESCRIPTION OF POWDER.	1st range in degrees.	2d range in degrees.	3d range in degrees.	Mean range in degrees.	Remarks.
Pegou, Andrews, & Wilkes' single seal.	82	81	82	82	
do. do. double seal.	95	84	95	91	
do. do. Canister,	110	105	105	107	
Edinburgh.	93	93	93	93	
London,*	78	82	82	81	
Dupont de Nemours, & Co.	112	115	119	115	Being 8 degrees stronger [than Pegou, Andrews & Wilkes' Canister.

By this it will be seen, that Dupont's powder is eight degrees stronger than the best sample of foreign, namely Pegou, Andrews & Wilkes'.

Having tested the strength, I shall now proceed to show the quickness of the different samples, as proved by a machine invented by Mr. A. Dupont. The manner of testing quickness, upon this machine, is both simple, and satisfactory. It is nothing more, than burning a train of twelve feet, or one hundred and forty-four inches, of each of the two samples to be tried; these trains are laid parallel to each other, and the board being graduated, you see plainly the comparative quickness of each sample. The following, is the result of these experiments; Dupont taken as the standard, one hundred and forty-four.

TABLE.

DESCRIPTION OF POWDER.	Inches.	DESCRIPTION OF POWDER.	Inches.	Difference in favour of Dupont's. Inches.
Dupont's	144	Pegou, Andrews & Wilkes' double seal.	96	48
Dupont's	144	do. do. Canister.	103	41
Dupont's	144	Edinburgh.	128	16
Dupont's	144	London.	102	42

By this it will be seen, that there exists a still greater difference in favour of Dupont's powder, over the foreign, in point of quickness, than in that of strength. When we consider the difference between one hundred and forty-four, and one hundred and three, we perceive that Dupont's powder burns nearly one third faster, than Pegou, Andrews & Wilkes' justly celebrated canister. The Edinburgh powder, comes nearest Dupont's, in point of quickness, burning as one hundred and twenty-eight, to one hundred and forty-four, making a difference of one ninth, in favour of Dupont's; although it falls short of Pegou, Andrews & Wilkes', in strength.

I must also remark, that the residuum, in burning all these powders, is much greater than in Dupont's, consequently, the latter also possesses the quality of cleanliness in a greater degree than the others.

Having now given you the result of those experiments, without favour, or prejudice, and merely that your book might contain such information, as would put it in the power of any one to select the best powder, I will only add, that I hope and trust, every sportsman, who believes in the authority of this statement, and who yet purchases foreign powder, will, at least, have the candour to acknowledge, that it is from prejudice, and not from judgment, that he prefers it.

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* That called London powder is said to be an inferior quality of the Edinburgh.

With much esteem,
I am your obedient servant,
T. J. B.

Notice of a new mode of purifying Gas from Coal.

[To the Editor of the London Journal of Arts.]

Sir,—A patent having been recently granted to me for purifying coal-gas, by means not hitherto used for that purpose, (and knowing your readiness to give early publicity to every new invention,) without waiting until my specification shall be enrolled, I take the liberty of addressing to you this communication, which you will notice, or reject, as you may think proper.

It would be superfluous to trouble you with the details of gas-making, I will only remind you with regard to the purification, that it has always been an offensive and complicated process, conducted at an expense of from three-pence, to a shilling, per 1000 feet, according to the local price of lime, of which many hundred tons are annually required in a large work, producing a most inconvenient accumulation of refuse.

In the wet system, the vast quantity of lime-water employed, and the difficulty of disposing of it afterwards, are obvious objections, exceeded only by those of the dry system, which occupies more labourers, injures their health, wastes a great deal of gas at each change of the lime, whilst without the most unremitting superintendence, the quality of the gas will either be impoverished by the purification, or become infamously bad.

The greatest inconvenience of the present methods, next to the lime heap, is the ammoniacal liquor, produced by thousands of gallons in large works; which, if not evaporated, is usually either carted away with the ashes, or allowed to flow into the adjacent roads and drains; in both cases, to the great annoyance of the public.

By my new patent process—1st. All these nuisances are effectually removed. 2nd. The expense is materially diminished. 3d. The ammoniacal liquor is manufactured into an alkali far superior in effect to lime, and less than a fiftieth part of its bulk.

I have only to add, in explanation, that I pass the coal-gas from the condenser, simultaneously with a stream of ammoniacal gas, into a common receiver, and thence through water into the gasometer.

I have practised this method on a large scale, at the works of the Birmingham and Staffordshire Company, with complete success. The apparatus is simple and cheap, the labour scarcely any, and the gas is very white, with great illuminating power. As little or no alteration will be necessary in works already established, I entertain no doubt of its general adoption.

I am, sir,
Your obedient servant,
J. F. Ledsham.

Edgbaston, near Birmingham, April 20, 1827.

French Patents, granted in the third quarter of 1826.

To J. C. M. Baron, Paris, for a new construction of baking ovens —10 years.

Count Lammartiziere, Paris, for a mechanism to propel boats against the stream—10 years.

Th. Hipert, Montpellier, for a process to draw and spin silk—10 years.

J. M. Lepetou, Paris, for an ingredient to destroy bugs—5 years.

B. Large, Lyons, for a system of boilers for steam engines—15 years.

G. and M. Diddman, Strasbourg, for a horizontal bobbin, with a vertical pressure, to be employed in spinning machinery—15 years.

P. C. Chevedu, Paris, for a new billiard table—5 years.

E. N. Favreau, Paris, for a hydraulic power applicable to factories—15 years.

V. E. Guilleaume, Paris, for improvement to M. Laforesi's hemp and flax break—5 years.

J. Nicholson, Paris, for an apparatus of portable gas—15 years.

Moses Poole, London, for a composition imitating gold—15 years.

Moses Poole, London, for a process to decorate "in relief"—15 years.

L. H. Truffant, Paris, for a mechanical inkstand—10 years.

Belanger, St. Leger, father and son, for a clearing cylinder for carding engines—10 years.

L. P. Fournier, Paris, for children's bolster caps—5 years.

J. B. Souton, Rouen, for a washing apparatus to cleanse wool—10 years.

Arnaud, Fournier and Westermann, Paris, for a system of machinery to comb, prepare, and spin, long wool—10 years.

N. A. Mercier, Louviers, for a conical motion to carry up the carriage in spinning mules—5 years.

J. Ganahl, North America, for a rotative steam-engine—15 years.

C. A. Thiselton, London, for a locomotion to propel carriages—10 years.

B. L. Berthaut, Paris, for printing rollers with slots and nibs—5 years.

H. Pellicat, Paris, for a power-loom—15 years.

P. E. Kinkalla, Paris, for a system of navigation—15 years.

M. P. Guersaut, Caen, for a process of manufacturing, at the same time, lace, and embroidery—5 years.

LIST OF PATENTS IN ENGLAND.

Which passed the Great Seal, in December, 1826, *and in January and February*, 1827.

To Thomas Morrison, Esq. for his invention of a method or process of rendering boots, shoes, and other articles, water-proof—Sealed 22d December.

To David Redmund, Engineer, for his invention of certain improvements in the construction and manufacture of hinges—22d December.

To Elijah Galloway, Engineer, for his invention of an improved rotatory steam-engine—29th December.

January, 1827.

To John Whiting, Architect, for his invention of certain improvements in window sashes and frames—9th January.

To James Frazer, Engineer, for his having invented an improved method of constructing capstans and windlasses—11th January.

To James Frazer, Engineer, for his having invented an improved method of constructing boilers for steam-engines—11th January.

To William Wilmot Hall, of the city of Baltimore, in the United States of America, at present residing in the city of Westminster, in the county of Middlesex, Attorney at Law, in consequence of a communication made to him from a foreigner residing abroad, for a new invention of an engine for moving and propelling ships, boats, carriages, mills, and machinery of every kind—15th January.

To William Hobson, gentleman, for his new invented improved method of paving streets, lanes, roads, and carriage-ways in general —15th January.

To James Neville, Engineer, for his new invented improved carriage, to be worked or propelled by means of steam—15th January.

To William Mason, patent axle-tree maker, for his invention of certain improvements in the construction of those axle-trees and boxes for carriages, which are usually termed or known by the names of mail axle-trees and boxes—15th January.

To Robert Copland, gentleman, for his invention of certain improvements upon a patent already obtained by him for gaining power —16th January.

February, 1827.

To Robert Barlow, for a new combination of machinery, or new motion for superseding the necessity of the ordinary crank in steam-engines, &c.—1st February.

To John Frederick Daniel, Esq., for improvements in the manufacture of gas—1st February.

To John Oldham, of the city of Dublin, gentleman, for improvements in the construction of wheels designed for driving machinery, which are to be impelled by water or by wind, and which said improvements are also applicable to propelling boats and other vessels—1st February.

To Ralph Hindmarsh, master mariner, for an improvement in the construction of capstans and windlasses—1st February.

To Robert Stirling Clerk, minister of Galston, in Ayrshire, North Britain, and James Stirling, Engineer, in Glasgow, Lanarkshire, North Britain, for certain improvements in air engines for moving of machinery—1st February.

To John White, of Hants, Engineer and iron founder, for improvements in the construction of pistons or buckets for pumps—1st February.

To Samuel Parker, bronzist, for improvements in the construction of lamps—1st February.

To Antoine Adolphe Mariellan Marbott, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, with whom he is connected, for an invention of certain improved machinery, for working or cutting wood into all kinds of mouldings, rebates, cornices, or any sort of fluted work—3d February.

To Sir William Congreve, Baronet, for his having invented a new motive power—8th February.

To William Stratton, Engineer, for an improved apparatus for heating air by means of steam—12th February.

To John George Christ, gentleman, in consequence of a communication made to him by a certain foreigner residing abroad, for certain improvements in copper, and other, plate printing—14th February.

To Philip Jacob Heisch, of America-square, in the city of London, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, with whom he is connected, for certain improved machinery for spinning cotton—20th February.

To Charles Barwell Coles, Esq. and William Nicholson, Civil Engineer, in consequence of a communication made to them by a certain person residing abroad, for a certain invention or new method of constructing gasometers, or machines or apparatus for holding and distributing gas, for the purpose of illumination—20th February.

To William Benecke, gentleman, in consequence of a communication made to him, by M. William Pescatore, a foreigner residing at Luxemburgh, in the kingdom of the Netherlands, (on whose behalf this patent is taken,) for an invention of a machine for grinding or crushing seeds, and other oleaginous substances, for the purpose of extracting oil therefrom—20th February.

To William Jefferies, of Middlesex, brass manufacturer, for his invention of certain improvements in calcining, or roasting and smelting, or extracting metals and semi-metals, from various kinds of ores, and matters containing metals or semi-metals—20th February.

To Pierre Erard, musical instrument maker, in consequence of communications made to him by a certain foreigner, residing abroad, and discovered by himself, for an invention of certain improvements in the construction of piano-fortes—20th February.

To Augustus Count de la Garde, in consequence of a communication made to him by a certain foreigner residing abroad, for a method of making paper, of various descriptions, from the bullen, or ligneous parts, produced from certain textile plants; in the process of preparing the same textile plants, by the Rural mechanical brake, (for the exclusive use of which he has already applied for a patent,) and which substances are to be employed alone, or mixed with other suitable materials, in the manufacture of paper—20th February.

To William Smith, of Sheffield, merchant, for his improved method of manufacturing cutlery, and other articles of hardware, with the means of rollers—20th February.

List of Patents granted in the United States, in November and December, 1826.

For Inventions and Improvements.

In a set auger, for boring hubs or naves of wheels; Sheldon Cadwell, Windham, Conn't., Nov. 20.

In the construction of furnaces for anthracite coal; Wm. Church, Boston, Mass., Nov. 20.

In the machine for pressing cotton; Jas. Boatwright and Jas. Nathans, Richland, S. Carolina, Nov. 21.

In the umbrella and parasol; William Sleeper, Philadelphia, Nov. 22.

In making saddle trees, George Wilkes, Fredonia, Indiana, Nov. 22.

In a spinning machine, called the domestic spinner, Lafferred Totten, Schoharie, N. York, Nov. 22.

In fire arms, Fordyce Ruggles, Hardwick, Mass., Nov. 24.

In the washing machine, Burroughs Beach, New Milford, Conn't., Nov. 24.

In the application of the screw in propelling machinery; Wm. H. Godfrey, Rochester, N. York, Nov. 27.

In the locomotive steam saw mill, W. G. Berry and J. T. Osborn, Cincinnati, Ohio, Nov. 22.

In the grate and blower for Lehigh coal, S. C. Mott and W. Holmes, New-York, Nov. 26.

In the mode of making clay pipes; John Bower, East Bethlehem, Penn., Dec. 1.

In the mode of spinning wool, cotton, &c.; Seth Boyden, Foxborough, Mass., Dec. 7.

In the dairy cooler; David Witmer, Paradise, Penn., Dec. 7.

In the manufacture of silver spoons, &c.; William Gale, New-York, Dec. 7.

In the washing machine; David G. Dunham, New Brunswick, N. J., Dec. 7.

In the mode of propelling the cotton gin; Peter Knox, Augusta, Georgia, Dec. 7.

In the trip hammer; Philip Petts Read, Mercer, Maine, Dec. 7.

In a self-feeding brick press; John Winslow, Portland, Maine, Dec. 8.

In the circular re-acting saw; William Avery, Cazenovia, New York, Dec. 8.

In the paddle wheel for propelling boats; Wm. F. Kearsing, New York, Dec. 8.

In distilling all kinds of liquor; Norman and Anson Wolcott, Bloomfield, N. York, Dec. 8.

In the mode of sawing veneers, &c.; John P. Atten, Manchester, Mass., Dec. 8.

In the thrashing machine; James Hyde, Pembroke, N. York, Dec. 9.

In the mode of propelling boats and vessels; John James Girard, Baltimore, Dec. 12.

In the mode of manufacturing wool, &c.; John Goulding, Dedham, Mass., Dec. 15.

In the kiln for drying and curing tobacco; Edmund Pendleton, Louisa County, Vir., Dec. 18.

In the machine for pressing cheese, cider, &c.; Lebbeus Caswell, Harrison, Maine, Dec. 18.

In the machine for breaking hides; Hezekiah S. Clark, Randolph county, N. C., Dec. 22.

In the machine for manufacturing slate; J. M. Porter & P. S. Maltes, Easton, Penn., Dec. 22.

In the mode of drawing lotteries; John C. Rives, Washington, D. C., Dec. 22.

In the machine for planing boards; Herman Atten, ************** Dec. 22.

In the machine for planting cotton, corn, &c.; John Lobdell, Warren county, Mis., Dec. 26.

In heating and boiling water, &c.; George J. Payne, Lockport, N. York, Dec. 27.

In the machine for pressing and packing cotton; James H. M'Clelland, Fairfield District, S. C., Dec. 28.

In the machine for making the hubs of wheels; Isaac Willbur, Madison, N. York, Dec. 28.

In a revolving timber plane; Daniel N. Smith, Warwick, Mass., Dec. 28.

In the marine rail way; Richard Ward, N. York, Dec. 28.

In making hats by the application of steam; William Harkins, Wheeling, Virginia, Dec. 29.

In the machine for spinning wool, cotton, &c.; Seth Boyden, Foxborough, Mass., Dec. 29.

In the pendulum motion for machinery; Justin Jacob, Montreal, Canada, Dec. 29.

In the evolution and management of heat; Eliphalet Nott, Schenectady, N. York, Dec. 29.

In bedsteads; Samuel Davis, Catskill, N. York, Dec. 29.

In the construction of fire-places, furnaces, &c.; John W. Bott and Wm. Lyman, Boston, Dec. 29.

In the lithontriptor; Isaiah Lukens, Philadelphia, Dec. 30.

In the machine for grating corn, apples, &c.; Camm Moore, Guilford county, N. C., Dec. 30.

In a revolving coal sifter; Thomas Borbidge and Anson Martin, Kingston Township, Penn.

In the machine for pressing hay, cotton, &c.; David Flagg and Charles Peck, Gardiner, Maine.

NOTICES.

Debts and Credits.

The Edinburgh Journal of Science, for April, has copied from Newton's Journal, a method of producing a fine black colour, originally published in this Journal, with remarks by the editor. In this last version of the article, all traces of the Franklin Journal are lost, and the remarks of its editor, attributed to Mr. Newton, by name. We attach no great importance to the article in question, nor do we suspect, that the change in its aspect has arisen from design, but entirely from inadvertence; still we are tenacious on this point, as from the state of things in this country, and in Europe, we draw largely upon their stores of information, contributing but little in return, and are therefore less willing to be deprived of our 'one talent.'

Under this head, we will also remind our subscribers, that the subscription for the present year, is now due.

Professor CLEVELAND'S *Mineralogy.*

Professor Cleveland, is now engaged in preparing for the press, another edition of his Mineralogy, in which the state of this Science, at the time of the publication of the work, will be exhibited, as far as may be practicable.

"*Upward Forces of Fluids.*" In the last number of Dr. Silliman's Journal, Mr. Genet has replied to, or rather noticed, our remarks upon this subject, in our January number. He shall hear from us again in our next, and also, through the medium of Dr. Silliman's Journal.

To Correspondents.—In our last number, we offered an apology to some of our correspondents, whose communications were delayed, on account of the engravings; these were to be executed by an artist residing out of the city; a gentleman, to whose care they were entrusted, lost the trunk in which they were contained, and it has not yet been recovered. We must depend upon the gentlemen who furnished the articles, to favour us with fresh drawings, as the originals were in the lost packet. The drawing and description of Mr. Malin's furnace, for smelting iron with anthracite; Mr. Stott's canal boats, and Colonel Long's steam engine furnace, were among the 'missing.'

Dr. Fearn's ingenious mode of applying a compensation rod to a pendulum, could not be engraved in time for this number.

The essay on Centrifugal force, by T. W. Bakewell, has come to hand, and shall appear in our next.

The report of the Franklin Institute, upon the Anémotrope of M. Biard, of Paris, should have appeared this month, but we have an engraving of it in progress, which will render the report more clear, and acceptable; and we have, therefore, determined to let them accompany each other. The model presented by M. Biard, has been deposited among those of the Institute.

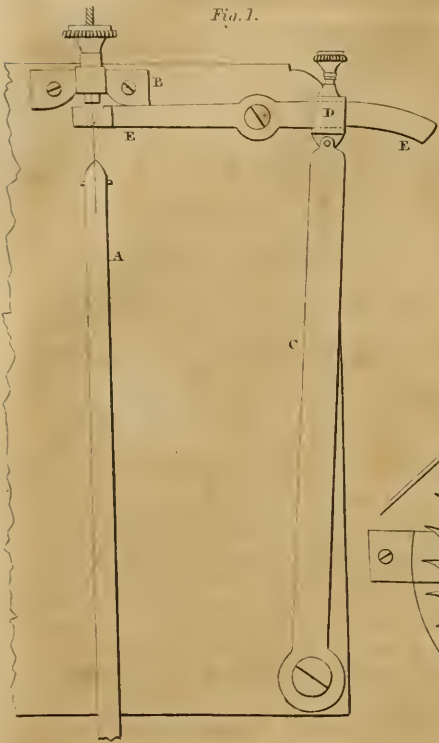

Fig. 1.

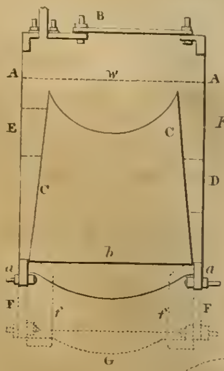

Fig. 2.

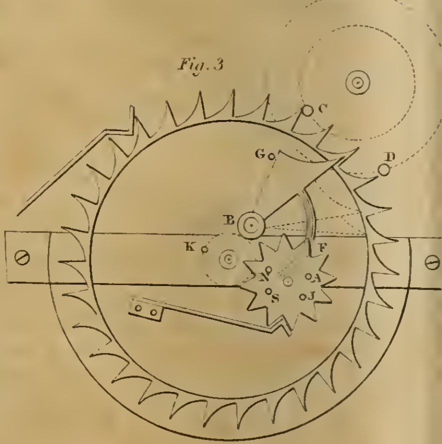

Fig. 3

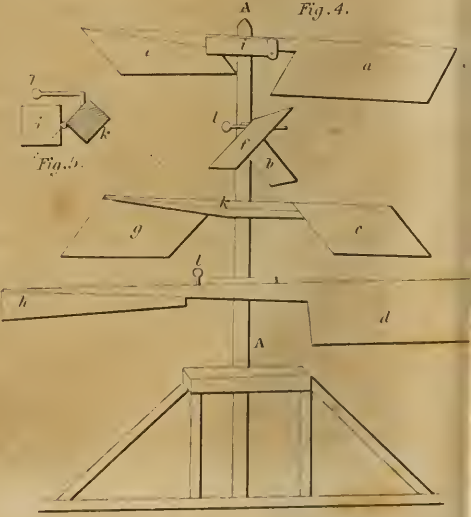

Fig. 4.

Fig. 5.

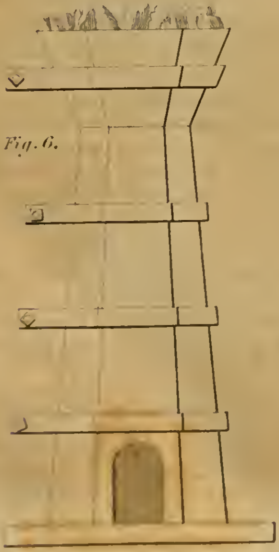

Fig. 6.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

AUGUST, 1827.

Essay on Earthenware and Porcelain.

[From Parkes' Chemical Essays.]

In attempting the history of the manufacture of European porcelain, it may be remarked, that although porcelain had been brought into this quarter of the world before Christ, there is reason to believe that the introduction of the knowledge of making porcelain in Europe was but of late years, as will be seen in the sequel. Porcelain is not made even now in the Indies; what is consumed there is all imported either from Persia, Japan, or China, and the other kingdoms between China and Pegu.

The English, cannot, I presume, lay claim to much excellence in their manufacture of earthenware, before the time of the late Mr. Wedgwood, who began his indefatigable researches about the year 1750: for, in the beginning of the last century, all the best tiles, and even the finer sort of bricks, were imported from Denmark, Germany, and Holland. Not but that bricks and tiles of clay had long been made amongst us; for there is an act of parliament now on the statute books, that was passed in the reign of Edward IV. which directs the time for digging the earth, the manner of making the bricks, &c.; and it is so expressed, that we have reason to conclude that bricks had been made in England from time immemorial. While on this article, I am desirous of mentioning, that there is a paper on the process of burning bricks, in the third volume of Bergman's Chemical Essays, and that it contains many hints which may be useful to those who are engaged in that occupation.

It seems strange, that our remote ancestors did not arrive at greater perfection in the manufacture of all these articles, when it is considered that the island produces not only a great variety of clays, but also all the other materials necessary for the production of the best earthenware and porcelain. Dr. Martin Lister, who wrote in the latter part of the seventeenth century, distinguishes no less than two-and-twenty different sorts of clay in Britain, which fell under his own observation. Moreover, the exquisite pieces of workmanship which were produced at different periods by the English sculptors, show that there was no deficiency of genius and skill among our artists, who probably conceived that the working in clay was beneath their attention.

The common stoneware, and that called white enamel, have been made in various countries of Europe ever since the fifteenth century. The former of these is distinguished by a glaze, made by means of muriate of soda; the latter is covered with a real glass, rendered opaque by the white oxide of tin.* Stoneware is the only article of pottery that can be employed for chemical purposes, where a great heat is required. Macquer says that our best common stoneware is the most perfect pottery that can be, and that it has all the essential qualities of the finest old Japanese porcelain. Mr. Pott, the author of *Lithogeognosia*, has written a treatise expressly to explain the requisite perfections of stoneware, for the purpose of chemical vessels; but I conceive that what is made at Lambeth near London by the best of those manufacturers, is susceptible of but little improvement. For boiling sirops, and for many other culinary purposes, the Lambeth stoneware is the best article that can possibly be employed; as it is cheap, will stand a great heat, and is perfectly wholesome; whereas many of the earthen utensils used in our kitchens, are glazed with lead, and consequently are extremely dangerous. Several years ago, I adverted to this subject in another work; but I was desirous of repeating the admonition now, because I consider the health of the community must be impaired by the frequent use of earthen vessels which are covered with the common Staffordshire glaze. The acetic acid will readily dissolve the oxide of lead; hence the boiling of pickles, and the making of other culinary preparations in such vessels, must be highly improper.

The white enamel ware, was brought to its present state of perfection, by Bernard de Palissy, a native of the diocese of Agen, in the province of Guienne in France; a spot celebrated for being the birth-place of the memorable Joseph Scaliger.†

Palissy was in a low station of life; but he was eminent for his knowledge, industry, and talents. There were indeed so many interesting traits in his character, that I trust, I shall be excused, if I recite a few of the chief circumstances of his history.

He is said to have been a skilful painter upon glass,‡ but he was more generally known as a chemist. Originally, he was a land-surveyor and draughtsman; but his taste for natural history led him to abandon this employment, and induced him to travel for instruction over the whole of France and Lower Germany. An accidental circumstance threw into his hands a cup of enamelled pottery; and, from that time, his whole attention, and fortune, were taken up in experiments on enamels.* Nothing can be more interesting than the narrative which he himself has given of his labours.

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* The oxides of many other metals are used in different branches of pottery, as will be shown in connexion with the latter part of this subject.

† Scaliger is called *memorable*, because he was not only well versed in all the sciences, but understood thirteen different languages. It has been said that he was the most learned man that any age ever produced. The variety of subjects on which he wrote with applause, is truly astonishing.

‡ In the time of Palissy the art of painting upon glass was nearly lost. In this country, it was classed with the ARTES PERDITAE; but Mr. Walpole has

He exhibits himself as building and rebuilding his furnaces, always on the eve of success; worn out by labour and misfortune; the derision of the public; the object of the angry remonstrances of his wife; and then as being reduced to such an extremity as to burn his furniture, and even some of the wood-work of his house, to keep his furnaces going. His workman presses him for money, he strips himself and gives him part of his clothes. But at length, by dint of indefatigable labour, constancy, and genius, he arrived at the desired degree of perfection, which gained him the esteem and consideration of the greatest men of his age.

He was the first who formed a collection of natural history at Paris. He even gave lectures on that science, and received a moderate subscription from each of his auditors, under the obligation of returning it four-fold if any thing he taught should prove false. He was the author of many singular books on subjects of agriculture, fire, earth, salts, &c. that are now very difficult to be found, and it is to him especially, that Buffon is indebted for many useful hints.

Palissy was the first who ventured, in the face of the priests, to affirm that fossil shells and calcareous mountains are the remains of real shells; he was also the first who taught the true theory of springs, and was in all respects an eminent and accomplished man. The very form of his works, exhibits a proof of original genius; they consist of dialogues between Theory and Practice, in which Practice is always the instructer, while Theory is represented as a scholar, proud of his own understanding, but indocile and ignorant.

The high reputation he acquired, and the obligations under which his countrymen stood indebted to him, were however not sufficient to defend him from the persecution of the League, for, being a protestant; Matthew de Launay,† one of the greatest fanatics of his day, caused him to be dragged to the Bastile at the age of ninety years, where he signalized himself by acts of firmness and heroism.

His reply to Henry III. deserves to be commemorated. "My good man," says the King, "if you cannot reconcile yourself to the matter of religion, I shall be compelled to leave you in the hands of my enemies." "Sire," said Palissy, "I was perfectly ready to sur-

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shown, by a regular series of artists and their performances, that this secret was never entirely lost. Walpole's *Anecdotes of Painting*.

* The modern enamel painting, is quite a different art. This was invented by John Petitot of Geneva. An account of his experiments and discoveries may be seen in the Biographical Dictionary, article *Petitot*, and also in Grainger's Biographical History, vol. ii. p. 288.

† This man must not be confounded with the celebrated De Launay who wrote "Remarks on the Roman Jurisprudence," and died in 1693.

render my life; and if the action could have been accompanied with any regret, certainly it must have vanished, after hearing the great King of France say, 'I am compelled.' This, sire, is a situation to which neither yourself, nor those who force you to act contrary to your own disposition, can ever reduce me, because I am prepared for death; and because, neither your majesty, nor your whole people, have the power to compel a simple potter to bend his knee before the images which he fabricates." This venerable man died about the year 1590.

Several of the nations of Europe, at the dawn of the eighteenth century, could not but regret that the knowledge of the manufacture of porcelain had not been introduced among them. At this time, however, a fortunate circumstance aroused the attention of the French people, and directed it to this important subject.

Francis D'Entrecolles, who had resided many years in China as a Christian missionary, a man of insinuating manners, and of a mild and affable deportment, had the address to procure specimens of the materials used by the natives, in their porcelain, and these he sent to France, with a summary description of the Chinese processes.

It may appear strange that so jealous a people as the Chinese are known to be, should have allowed of European missionaries being settled among them. The ecclesiastical historian Mosheim, has, however, investigated this subject, and it is highly amusing to read his account of the arts which the Jesuits practised, to interweave the doctrines of Jesus, with those of Confucius, and to learn how they ingratiated themselves with the inhabitants of that country.

When the specimens arrived in France, the celebrated Reaumur undertook a series of experiments to discover the method of imitating the Chinese productions; and he persevered with amazing industry, until he had obtained the main object he had in view.

The difficulties which he had to encounter; the mistakes he made during the investigation; the cause of those mistakes, and the extent of his success, are all well detailed in the French Dictionary of Chemistry, translated by Mr. Keir, and will be found under the article Porcelain. Mr. Reaumur himself, in the years 1727 and 1729, also published a full account of his progress in this inquiry, in two memoirs addressed to the Academy of Sciences, and which were printed in their Transactions.

While Reaumur was engaged in these experiments, porcelain was begun to be manufactured in Saxony, and soon afterwards other manufactories of it started up in different parts of Germany. We had also an establishment for making it at Chelsea; and since that period various companies in different parts of England, France, and Italy, have been founded for the same purpose.

The first person who made porcelain for sale in Saxony, was the Baron Botgar, and it is probable that his was the first manufactory of real porcelain in Europe. In order as much as possible to preserve this art as a secret, the works were rendered impenetrable to any but those who were immediately employed in them.

M. De la Condamine, in his journey into Italy, visited a manufactory of porcelain established at Florence by the Marquis de Ginori, governor of Leghorn, where he saw statues and groups half as large as nature, and modelled from some of the finest antiques. He describes the body of the ware as being equal to the best Chinese manufacture, and that it would be extremely beautiful if it had a whiter glazing; but that the Marquis was determined to use only such materials as were found in his own country. How superior are the advantages which the English nobility possess for improving the manufactures of these kingdoms, if it were thought becoming in them to attend to such objects! In France, the Count de Lauraguais engaged in the pursuit of improvements in porcelain for several years with uncommon ardour and success. [*French Chemical Dictionary.*

The establishments of the most consequence among the moderns are, one at Dresden; the King of Prussia's own manufactory at Berlin; and the extensive works which belonged to the late King of France at Sevres, near Paris. There is also a considerable establishment for the manufacture of porcelain at Montpelier; a descriptive account of which, together with the process for making the peculiar glaze which is employed there, was published some years ago in the *Annales de Chimie.*

Frederick the Second, King of Prussia, had conceived so high an opinion of the importance of the manufactory at Dresden, that when he conquered Saxony he took many of the best workmen away by force, and transported them to his own pottery at Berlin. This manufactory at Berlin since the year 1763 has been carried on for his majesty's own private account, with success and with good taste. Five hundred men have constant employment in it, and large quantities of the porcelain are annually exported.

Mr. Jonas Hanway, in the account of his travels, has published a particular detail of an immense collection of porcelain which is laid up in the Chinese palace at Dresden. The whole recital would be unsuitable to these essays; but the following particulars will show how the Elector of Saxony valued himself on account of the perfection to which the manufacture of porcelain had arrived in his dominions.*

" The vaults of this palace," says he, " consist of fourteen apartments filled with Chinese and Dresden porcelain. One would imagine there was sufficient to stock a whole country; and yet they say, with an air of importance, that a hundred thousand pieces more are wanted to complete the intention of furnishing this single palace."

" Here are a great number of porcelain figures of wolves, bears, leopards, &c., some of them as big as the life; a prodigious variety of birds, and a curious collection of different flowers. A clock is preparing for the gallery, whose bells are to be also of porcelain: I heard one of them proved, and sufficient to form any music; but the hammers must be of wood."

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* The potters of Dresden were always as curious in the management of their ovens as they are in the manufacture of their porcelain. Nothing but white wood is employed for heating the kilns, and this is never used till it is become thoroughly dry.

"Here are forty-eight large China vases, which appear to be of no use, nor any way extraordinary, except for their great size; and yet his Polish majesty, purchased them of the late King of Prussia, at the price of a whole regiment of dragoons."

In the course of the narrative, Mr. Hanway mentions one very interesting circumstance, viz. that samples of the *first efforts* to make china in Saxony, were laid up by the King of Poland in this palace, together with specimens of all the improvements, in their several gradations, from the first, till the time when the manufactory arrived at its utmost state of perfection;* an idea truly philosophical, and which reflects more honour on his memory, than the bartering away the liberties of his subjects, for pieces of foreign porcelain.

The passion for collecting porcelain, has been common in most countries. Dr. Campbell remarks that "to Ormus, at the proper season of the year, resorted the merchants from Persia, Arabia, and Turkey. At these seasons," he says, "the city wore a new face, the outsides of the houses were adorned with cabinets of porcelain, and with beautiful paintings; and all the riches of the East blazed in the eyes of the captivated spectator."

The greatest part of the earthenware that is now made in England is manufactured in a particular district of about ten miles extent, well known by the name of the Staffordshire Potteries. Here earthenware has probably been made ever since the time of the Romans,† but there did not appear to have been any ambition among the manufacturers to improve the art, or to produce any works of taste, till the late Mr. Wedgwood engaged in the business. This most excellent man brought modellers from Italy and from other parts of the continent, whom he engaged at high wages; and he also constantly employed a competent chemist in experiments, that nothing might be wanting which could conduce to extend the employment of earthenware throughout Europe, or that could in any way tend to give a permanency to the staple manufactory of the county which had given him birth.

Amidst a collection of the most beautiful medallions of British and Foreign Worthies, the manufactory at Etruria produces vases and urns in imitation of jasper and other variegated stones; a fine black porcelain, of which very beautiful vases and bas-reliefs are made, after antique patterns; Etruscan vases ornamented with encaustic paintings, after the antique; and bas-reliefs of a white composition, on coloured grounds, so as to have the effect of enlarged cameos. To the late Mr. Wedgwood the country is indebted for all these discoveries in the art of pottery.

Notwithstanding the energy with which Mr. Wedgwood devoted his inventive talents and chemical knowledge, to the improvement of his favourite manufacture, during the course of a long and industrious life, I have no doubt that chemistry might still confer many benefits on the potter's art, if the manufacturers in general would bestow such an education upon their children as would enable them to pay a proper attention to the cultivation of this science.

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* The potters in Saxony are so exact in the management of their manufactories, that they employ none but the purest rain-water for soaking the clay; and they prepare the clay only twice a year, at the equinoxes; conceiving that at those seasons, the water is less contaminated with foreign ingredients.

† In sinking pits, very evident remains of Roman potteries have been discovered, and at a considerable depth below the present surface of the land.

Impressed with this idea, I have myself frequently inspected several of the largest manufactories of earthenware in this kingdom, as well as many others of inferior note, and have examined their various processes with the utmost care and attention. A residence of several years at Stoke-upon-Trent, in the midst of the Staffordshire potteries, afforded me the best opportunities for this purpose, and enabled me to make those inquiries at my leisure, and to acquire that information, which none but an inhabitant could easily have obtained.

It will not, however, be necessary for me, while giving an account of this manufactory as at present conducted, to go much into detail; because, if this were the object I had in view, it would be necessary to devote a volume or more to the purpose; for I am acquainted with few manufactories in which the operations are more numerous and diversified.

On this account, I shall content myself with giving such an outline of the business as will afford the general reader a correct idea of the nature of the different operations; and at the same time shall propose, for the consideration of the manufacturers themselves, such hints for the improvement of some of the processes, as I conceive to be worth their attention.

[TO BE CONTINUED.]

Description of the Mode of Manufacturing Starch, in France.[*]

The starch of wheat, rye, barley, &c., being prepared by the same method, we shall treat of these grains without distinction, either as to their being used singly, or mixed in various proportions. The manufacturers prefer that grain which has been injured by remaining long in damp warehouses, and rendered improper for most other purposes; not only because it is cheaper, but because the starch, being less alterable than most other immediate products from vegetables, is still obtained in great abundance, with more facility, and often even in nearly an equal quantity, as from uninjured grain.

They commence the operation by coarsely grinding the grain; which is effected in the ordinary mills by raising the upper mill-stone, by which means the space between the two stones is augmented, and the grain passes through, merely bruised. If the grain employed be too wet, it sticks between the stones, from which it is with difficulty disengaged, and more power is required to obtain even this small quantity; but this inconvenience is avoided by a previous desiccation. After this first preparation, they steep the grain, thus bruised, in large tubs half filled with water, to which they add an eighth, or a tenth, part of the *sour water*, remaining from a former operation: by degrees fermentation takes place, and proceeds with a rapidity in proportion as the grain employed contains a greater quantity of gluten, or as the temperature of the atmosphere is more elevated. When fermentation has commenced, the liquor becomes viscous, acquires a degree of acidity, and at length is covered with a thickish crust of mould. In this state they term it *sour water:** this water is drawn off by means of a cock, placed at the height which the deposit occupies in the tub; or by means of a portable syphon, which serves for many tubs: but, previously, they take off the crust of mould, or *head*, with a skimmer; the greater part of the gluten is decomposed; and the products of this decomposition, with the extractive matter of the grain, are separated by this first decantation: they wash the deposit many times, and afterwards mix it with water, and throw it into a hair or wire-sieve, resting upon two pieces of wood, placed across the top of a vat. They have lately applied to this operation (in order to separate the coarsest bran) a revolving sieve, made in the manner of the Achimedian screw. This instrument is a cylinder, the interior of which is traversed by a continued band of diaphragms, disposed around an axis in the form of a screw; and on these the cloth is retained, in a cylindrical form. The axis of this sieve is made cylindrical at each extremity, and turns upon two proper bearings; it is placed obliquely, so as to form an angle of from 20° to 30° with the horizon: it may either be turned round by means of a winch or handle, in the same manner as the Archimedian screw, used in draining morasses; or by a leather strap and a pulley. The construction of this machine, is exactly the same as that of the elevating screw; only their functions being different, the movement given to them must be in a contrary direction; so that instead of the screw, as usual, raising portions of liquid from below, at intervals quickly succeeding each other, until they are finally discharged at the top of the screw, the machine is, in this case, constantly fed at its highest part, with the mixture formed by the deposit which we have before spoken of. A small stream of water runs upon the exterior of the metallic cloth, and incessantly washes it: the operation is thus carried on in a continued manner; and the bran, or ligneous covering of the grain, escapes at the lower part of the sieve, perfectly free from the starch which it contained. That which has passed either through the revolving sieve of the new machine, or the ordinary sieve of the starch-makers, affords, by repose and decantation, a *sour water*, which is employed in the same manner as that we have before described. The deposit however, contains, besides starch, a quantity of very fine bran; to effect the separation of these two substances, it is beaten up with water, and left to settle: the starch precipitates first, and occupies the bottom of the vat; the bran falls next, and forms the upper part of the deposit. They remove the surface until they arrive at the starch, which is known by its whiteness and firmness: they rinse the surface of the starch, to free it from those particles of bran which may still adhere to it; they again beat up the white mass, thus rinsed, and pour the whole into a silk sieve, or into a machine similar to the one we have above described; but with this difference, that its exterior covering is formed of a cloth closer in its texture, resembling that of a silken sieve. By one, or other, of these means, they separate an additional quantity of fine bran, and the starch which passes is whiter, and purer: nevertheless, it must be again beaten up with water, suffered to repose, the supernatant water decanted, and the surface of the deposit be again rinsed, which is still a little soiled by the finest particles of bran. The starch is now very white: in general, however, its whiteness, and purity, depend upon the precautions which have been taken in the many washings, and on the fineness of the last sieve through which it has been passed.

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[*] From the Dictionnaire Technologique.

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* It is composed, according to M. Vauquelin, of water, acetic acid, acetate of ammonia, phosphate of lime, and gluten.

Desiccation.—This operation, although very simple, nevertheless requires many precautions; for the whitest starch, when taken from the last washings, often becomes of a brownish or greenish colour, which requires it to be again mixed with the common starch which is obtained from the rinsings, or from those grains which are the most injured, and which are classed, according to their whiteness, into various qualities. They put the starch, ready to be dried, into square baskets, (whose angles however are rounded off,) each being furnished with a loose cloth. These baskets are generally of the following dimensions: 20 inches long, 14 wide, and 11 high; they fill them as full as possible with starch, and compress it by slight jerks; they leave it awhile to drain, and stiffen; it is then carried to the drying-house. This is a large building, whose upper part is divided into many compartments, surrounded with shutters, and the interior furnished, near its sides, with stages of wooden planks, laid horizontally, at the distance of about 16 inches apart; there is also a level bed of plaster of Paris, formed close to these stages. They deposit the contents of their baskets upon this bed, and remove the cloths, which have quitted the baskets with the moulded blocks of starch.

The starch is thus brought to its first degree of desiccation: they carry it afterwards to the stages, and divide each block into sixteen parts, for the purpose of presenting a greater surface to the drying action of the air: these are very frequently turned, as well to accelerate the desiccation, as to avoid the least mouldiness, or dust, &c. which might soil the starch, and which there is less chance of guarding against, by a longer continuance on the stages: they then carry these pieces to a stove, first taking care to scrape their surfaces slightly; they are then divided into smaller pieces, by the hand, always keeping in view the drying of this substance as quickly as possible; they should be turned, from time to time, with a wooden spatula, to change their surfaces. By these precautions, which it is proper to increase, or diminish, according to the hygrometric state and temperature of the atmosphere, it is certain that the starch will be preserved in its original whiteness.

Knowing the composition of the various grains, of barley, wheat, &c.

we can thus establish the theory of what takes place in the preparation of starch. These grains contain much starch; the ligneous matter, forming the husks of the grain; a small variable quantity of gluten, albumen, and certain salts; amongst others, the phosphate of lime.

The re-action of the gluten upon the starch, occasions the formation of a little saccharine matter; the continued ferment in the mixture, causes the *spirituous fermentation*, and produces alcohol, and carbonic acid. This last is disengaged in the gaseous form, and from thence are derived the bubbles which arise, and burst, at the surface of the liquor. The *acid fermentation* immediately follows; the *sour water* necessarily excites this fermentation, from which results a new quantity of vinegar; and soon after, the gluten, by reason of the large quantity of azote which it contains, and its facility of spontaneous alteration, gives birth to the *putrid fermentation*, which developes ammonia; the gluten and the phosphate of lime are, in part, dissolved in the liquor by the acetic acid, and are partly held in suspension: the re-union of these principles forms the *sour waters* of which we have spoken.

It often happens that the *sour waters*, when they are poured upon the bruised grain, in the first part of the operation, subside, without occasioning any disengagement of carbonic acid gas, any sensible movement, or any other change than making all the liquor thick, gluey, and ropy. This alteration, to which they have given the name of the *viscous fermentation*, although of little importance here, is very remarkable; it is accidentally presented in many other cases, and particularly in the treatment of saccharine matters, where it is almost always injurious, and often occasions considerable loss.

Uses.—Starch is employed in many of the arts, although but in small quantities: painters, confectioners, laundresses, &c. make great use of it; physicians prescribe it as an aliment of a peculiar nature, and as a medicine; but in this case, as also in the manufacture of sugar from starch, they give the preference to the starch, or fecula, of the potato.

Composition.—Starch is formed in weight, according to M. Berzelius, of

Carbon	43,481
Oxygen	49,455
Hydrogen	7,064
	100.

P.

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VII. *Continued.*

4.—*Mr. Tennant's Bleaching Salt, or the Oxymuriate of Lime.*

Lime was impregnated with chlorine, for the purposes of bleaching, at an early stage of the improvements we are now detailing, by

Watt, Henry, and Cooper; but it does not appear that it was by them brought into their general practice, as they seem to have preferred the simple water, or the oxymuriate of potash. It was reserved for Mr. Charles Tennant of Glasgow, to improve the process of making it so as to render it both a cheap, convenient, and efficacious agent in bleaching.* The first process which he adopted for this purpose, has been already given. (Page 338, Vol. II.) He was deprived of the patent he had for the manufacturing of this substance, in consequence of a legal decision in the Court of Session. The loss of his patent stimulated Mr. Tennant to new efforts of ingenious invention, and he succeeded in combining chlorine with lime, in the dry way, which renders it easily portable to any distance at a small expense.† In consequence of this, his business has increased to a prodigious amount, while the bleaching processes have received great improvement. The expense also, is greatly lessened, as lime is so much cheaper than the alkalies which used to be consumed for this purpose, to a very great amount.‡

The concrete oxymuriate of lime, or Tennant's salt, as it is called by the bleachers, is, when prepared for immediate use, diffused by agitation in a quantity of water. This is allowed to stand for some time, till any insoluble matter contained in the lime, is precipitated, and the supernatant liquor remains transparent. The liquor thus clarified, is drawn off and diluted with a considerable proportion of water, when it is ready for the immersion of goods. This salt differs so remarkably from most others, that it cannot be procured from the solution, either in a dry mass, or in crystals, by evaporation; for when such a solution is evaporated, part of the acid escapes, and the rest is mostly converted into muriatic acid; so that, instead of oxymuriate of lime, muriate of lime is obtained. The dry salt can only be obtained by Mr. Tennant's process of using dry lime, in the first instance.

5.—*Tests for ascertaining the strength of Oxymuriaté of Lime.*

In treating of the other agents of bleaching, we have seen of how much importance it is to the manufacturer, to be able to ascertain the quantity of efficient matter, in any of the substances of commerce, which he has occasion to purchase. With respect to oxymuriate of lime, this ought, perhaps, to be still more attended to, insomuch as it is the principal agent for producing pure whites. But I am much mistaken, if any method has come into general use among bleachers, by which the quality of a given quantity of this substance can be ascertained.—They are under the necessity, indeed, of ascertaining the bleaching power of the diluted liquid, previous to immersing their goods, which is commonly done by an indigo test, and in this way, by observing the quantity of salt and the proportions of water used, they may make a rude guess, concerning the strength of the salt, when purchased; but this, at best, must be an inaccurate method of proceeding. To remedy those inconveniences, the ingenious Mr. Dalton instituted a course of experiments, in which he was successful in obtaining a test of easy application, for ascertaining the purity of oxymuriate of lime.

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* The oxymuriates of barytes and strontites, which were also mentioned in his patent, were found to be too expensive for practical purposes, as the latter substance could not be procured in great quantity, and the former could with difficulty be separated from the sulphuric acid with which it is usually found combined.

† So great is the reduction of expense from this cause, that it was proved upon oath, that, by using oxymuriate of lime, the consumption of ashes, in a single bleaching-green, has been reduced £3000 in value in one year.

‡ In order to produce this important agent, the chlorine gas is sent into a receiver, similar to that formerly described, which contains, in a pulverized form, the dry hydrate of lime; that is, lime slacked with the least possible quantity of water. The powder, during the influx of the gas from the distilling apparatus, is continually agitated, and the gas combines with it to a certain amount, or till the hydrate becomes saturated. The salt so formed, is a soft white powder, which possesses little of that intolerable smell so conspicuous in the gas. It is partially soluble in water, and its solution is little different from that obtained by the process in which the combination is formed in the solution of lime in water.

From these experiments it appears, that the green sulphate of iron is by far the best test of oxymuriate of lime. As the indigo test does very well in ascertaining the strength of the diluted liquor, and as it is very generally used, I cannot well omit detailing the manner of its application. Prepare a very dilute solution of indigo by dissolving, in the usual way, a pound of the best Spanish in four pounds of concentrated sulphuric acid, which proportions will generally be sufficient to produce saturation. When all the indigo is dissolved, one part, by measure, of this solution, is to be diluted with sixteen parts, by measure, of water, when it will be fit for use. To obviate any deception which may arise from the difference of strength in the indigo, it is best always to preserve some of a former preparation, to compare with the new, when, by a little management, it may be made equal. The quantity of water used is not material, provided that the same bleacher keep always to the same proportion. The strength of the bleaching liquor, is determined by the quantity of it, which is required to destroy the colour of any given portion of the test. In practice, it is usual to have two graduated glass tubes, one for the test, the other for the liquor, by which arrangement the efficient quantities are seen by inspection. Berthollet says he was informed by Mr. Watt, that the indigo test will not accurately show the strength of either oxymuriate of soda, or of potash, and recommends a decoction of cochineal, as not being so liable to inaccuracy, or deception. From what I can learn, however, this has not been found so convenient in practice, as the indigo test. Mr. Dalton's test from sulphate of iron, will soon, I imagine, supersede all others.

No. IV.—CHEMICAL AND PHYSICAL NATURE OF STUFFS.

No satisfactory account can ever be given of a chemical process, unless all the substances which are employed in it be minutely known, both as to their general nature, and, if possible, as to their composition when they are compounded.* This has not been properly attended to in any of the works on bleaching which have fallen into my hands, as none of them give any chemical account of the substances which are to be operated upon. This deficiency I shall attempt to supply, although I feel that my information is inadequate to do it justice, and in order to render it more perfect, it would require more laborious analytical and experimental research, than either my ability or leisure will allow. I have derived the best part of the knowledge I have of this subject from Home, Fourcroy, Kirwan, and Bancroft.

Animal substances differ very much from vegetable, both in their physical structure and chemical composition. Wool and silk, for example, are much looser in their texture, and have less adhesion between their constituent parts, than cotton and linen, and are therefore more disposed to combine with other matters which are brought into contact with them, and manifest stronger affinities for the ordinary agents of bleaching.† Their chemical composition is still more dissimilar from that of vegetables, in containing a greater proportion of hydrogen, and particularly of nitrogen, which, in vegetables, is usually present in but small quantity. It is the tendency of these to assume the gaseous form, which renders the adhesion of the ultimate principles in silk, and wool, so slight, and easily overcome. When they are subjected to distillation, these two principles seem to unite, and form with oxygen the volatile alkali, which is seldom developed in any quantity from vegetables by the retort, the several acids being the ordinary product of the still. It is this that renders animal substances more liable to the putrefactive fermentation, and vegetables to the vinous and acetous. Wool, and silk, yield more oil than most vegetables; cotton, indeed, contains very little, and linen not much more, although the seed of flax affords it in abundance. This accounts for the brighter flame of the animal substances during combustion, when also the presence of ammonia is distinctly perceived from the pungent smell which, in that case, is emitted. Silk, and wool, are much more easily decomposed than linen and cotton, from the enlarged sphere of affinity which their more numerous constituents produce. It is on this account, that the sulphuric, nitric, and muriatic acids, decompose, and weaken, the texture of silk and wool, while vegetables are but slightly affected by acids of the same strength. The nitric acid acts on the former by extricating their nitrogen, separating the fatty matter, and forming carbonic and oxalic acids. The sulphuric, extricates their hydrogen, a small portion of their nitrogen, and leaves a carbonaceous residuum. The alkalies, again, destroy animal substances by combining with their oils, which sheath their causticity, and form soap, while they affect vegetables but slightly. Silk is the least liable, of all animal substances, to be acted upon by acids or alkalies, as it is more nearly allied than wool, to vegetables, in its structure and composition. But I shall give a more specific description of those differences, beginning with the animal substances.

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* We would not, however, be understood to infer from this, that a knowledge of the structure and composition of the ultimate constituents of the substances in question, will much assist us in anticipating, without previous trial, the result of any process in bleaching; we merely infer that such knowledge may assist us to explain upon what the effects produced depend, and may suggest material improvements, both in efficiency and economy.

† This is well illustrated by what takes place in dying of a scarlet colour, the woollen cloth which is sometimes edged with cotton, as the cotton, being less easily affected, remains white after the wool has acquired the required shade; the same will happen if cloth be made with cotton warp and woollen woof, as has been experimentally shown by M. Dufay.—*Bancroft*.

1. *Silk.*—This substance is procured from cocoons formed by the caterpillar of the *Bombyx mori*, of Linnæus, previous to its transformation into a moth. It consists of filaments of great tenuity and comparative strength, which are uniformly covered by a very thin pellicle of a glutinous or gummy matter, which serves to render them stiff and elastic. They are usually of a yellowish tinge, from the combination of colouring matter, which M. Baumé found to consist of a resin perfectly animalized, affording, by distillation, the same products as other animal matters, and the concrete volatile alkali. (see Journ. de Phys. 1793.) This it is necessary to remove, in order to render the fibre pliant, and manageable, for the manufacture of cloth, which is commonly done by means of soap, according to a process described by Berthollet. Besides this gummy and colouring matter, M. Roard (Ann. de Chim.) found that there is another substance, like wax, which requires to be removed. He informs us that the gum is commonly in the proportion of 24 per cent., the colouring matter about 55 or 60, and the wax seldom more than 1, and often only about half that proportion. The gummy substance is soluble in water, and would be easily managed if the others were not present, for it unfortunately happens that the colouring matter cannot be dissolved by water; it is, however, soluble in alcohol, and also, together with the animal wax, capable of being removed by alkaline leys or by soap.* The silk procured from the cocoons of the Bombyx mori, seems to differ considerably in strength and composition, according to the different places in which the insects live; but my information is too scanty to be able to point out those differences with precision. In India and China, silk is procured from several other insects of the same tribe, which is strikingly different from the common silk. Dr. Roxburgh (Lin. Trans.) tells us of a phalena whose cocoons are remarkably soft, and white, or yellowish, but it being difficult to wind off the silk, it is spun like cotton, and

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* It was found by Mr. Mushat that silk contains more carbon than any of the other substances employed in the manufacture of cloth. He distilled, in the dry way, 200 grains of white silk stuff, and during the process there was a violent discharge of bituminous flame and smoke. The residuum was formed into a caked coal of a dense compact structure; cellular, though not in the least brittle. The colour was iron-gray, with a faint shade of copper. When struck, it was sonorous in a high degree. It weighed 62 grs. and had consequently lost by the process 138 grs. Silk, then, is composed of 69 grains volatile matter, and 31 of oxide of carbon. (Phil. Mag. xxxiii. 4.)

possesses a durability almost incredible, the life of one person being seldom sufficient to wear out a garment of it. Its texture and composition must be very different from common silk, as it will not bear washing in hot water. The Doctor mentions another sort of silk which is coarse, durable, and dark coloured, and much worn by the Bramins. The silk from Nankin in China is naturally pure white; but the Chinese, according to M. Baumé, (Journ. de Phys. 1793,) bleach a great quantity of common silk, and pass it for Nankin.

On the Growth and Preparation of the Straw used for Plait, in the Tuscan trade.

The Highland Society of Scotland, in their list of Premiums for the present year, state, that " they have every reason to be satisfied with the success of the premiums offered last year, and although the specimens produced in consequence, have done uncommon credit both to the manufacturers, and to the operative people in this country; yet, the result of the inquiry which the society has been able to make into this important object, leads them to the conclusion, that " until farmers raise the straw for sale, it is not likely that the manufacture of Leghorn bonnets will become general in Scotland. If straw could be got to purchase at a reasonable rate in this country, the great difficulty in extending the manufacture would be removed."

They have accordingly offered several premiums for this important object, and they add as follows:—

" The following observations have been extracted from some valuable communications which have reached the society from Mr. Horace Hall of Florence, Mr. Boswell of Kingcausie, and others; and are inserted here as perhaps affording information on some points of management in the growth and preparation of the straw used in the Tuscan trade, which may not yet be quite familiar in this country."

" The seed from which the straw for plaiting is grown, is a small round grain of wheat, called *grano marzuolo*, or, more properly, *grano marzolano.* It is so called from being sown in the month of March, and differs from common wheat in appearance, from its rounder and shorter shape. It is an error to suppose hats are made from rye, or any other grain in Tuscany. This *marzolano* straw is cultivated for the sole purpose of being made into hats; and is grown chiefly in the vicinity of Florence, and on the hills on both sides of the valley of the Arno. The growth of the straw is thus almost exclusively confined to a limited part of the province of Tuscany. A few years ago, the Pope aware of the source of wealth which this manufacture produced in that quarter, attempted to introduce the culture of it into his States. From the habits of the people, difference of soil or climate, or from all these causes conjoined, the plan did not succeed; and the Grand Duke of Tuscany having now allowed the prepared straw to be exported, the idea of cultivating it elsewhere seems to be altogether abandoned. Tuscan women, in the mean time, have settled themselves in various places, such as Vienna, Petersburgh, &c., where they carry on the manufacture with straw grown in Tuscany.

"This seed is sown on good ground, but not rich; some sow it on poorish land. In general, vines and olives bound the fields in which it grows, or are planted at intervals in the interior of these fields, like orchards in this country. The practice in sowing flax is known to every agriculturist; and nearly the same holds in regard to the *marzolano*, where the qualities especially to be obtained are fineness, tenacity, and toughness.

"To obtain the first, it is sown so thick, that each blade touches another. Manure is never made use of on the ground to be under *marzolano*. The seed is sown on the ground in a flat state, and a person must be taught the method of sowing it, which is done "underhand." The seed is then covered in, by hoeing the ground with a draw hoe, about three times the size of our common turnip hoe. This is done as near the first of March as the season will permit. From the beginning to the middle of July, (according to the season,) it is ready, which is known by the ear being fully shot, but before it is formed into grain. The plant is then, if a good crop, eighteen inches in height. The straw is not cut, but plucked by main force from the soil, and then exposed for the purpose of bleaching, not in bundles, but scattered about in meadows or gravel grounds, exposed to the evening dew and the mid-day sun, until it is perfectly yellow; but constantly watched, to gather it together, and put it under cover at the least appearance of rain, which would spoil it, and make it turn out completely speckled. After it is sufficiently bleached, it is tied in bundles, and brought to the manufactory, where children are employed to pluck the only part of the straw which serves for plaiting, that is, what is comprised betwixt the ear and the first joint in the stalk. If the weather is fine, in fifteen days after the crop is pulled, it will be ready to work into plait, "treccie" as it is called. The natives say that the dew tends greatly to whiten it; but if any rain falls, it is ruined. The manner of separating the top joints, is by a smart jerk of the hand. These are made up for sale, and the remainder thrown to the dunghill, for no animal will eat it.

"To obtain the whiteness so much prized, the straw is smoked with sulphur previous to being worked; the plait is also smoked, and, lastly, the hat. About Sienna, the process is simply a little sulphur set on fire in the bottom of a large chest, bunches of the straw being placed on long hazel rods across, and the lid shut down. Elsewhere, the articles are described as being placed in a small close room, in which a chafing dish of sulphur is placed, and set fire to. Sometimes the operation requires to be done twice before it succeeds.

"The straw for use is classed or stapled like our wool. Children or inferior hands work the coarse thick straw, while good hands work the fine only. Whether fine or coarse, it is only the part on which the spike grows that is made use of, and it is always the same plait, consisting of thirteen straws, which is worked. In the fine plait, there is a very great waste of straw, as they reject all that is in the least too thick, and they cut off a considerable part of the straw where it comes near the flower spike. Fine plait is not accounted good, unless very much drawn together, for which end it is worked very wet. The bunches of straw are always put into a small jar filled with cold water, which stands behind the worker. After being smoked and pressed, the plait is made up into hats by women who do nothing else; it is put together by the edges, not overlapped. On the operation of pressing a great deal depends. There are only two good machines for that purpose in the country.

"Such is the practice for procuring the hat straw. What they sow for seed is in other ground: not one fourth of the seed is used, and the grain is allowed to come to maturity in the usual way. It is said to be a capital wheat for *vermicelli*, *maccaroni*, &c. and also for making into bread.

"It ought to be taken into view, that, for the use of the manufacture in Scotland, the straw should not exceed 1-18th of an inch in diameter. When coarser, it does not answer the market; and much of the very finest straw is not required, because the bonnets made from it are too expensive."

On the Preparation of Artificial Slates.[*]

There have been for some years imported into Russia a species of Artificial Slates, manufactured by a person named *Alfuid Faxe*, of Carlscroon. These substances attracted the notice of several scientific men. M. Géorgi was instructed by the Academy of St. Petersburg to make an analysis of them, by which means he discovered their composition. They are a most invaluable substitute for slates; as they are much lighter, impenetrable by water, and incombustible. The following processes for manufacturing them, afforded the best results to M. Géorgi.

The substances employed, were 1st. A bolar earth, white, red, or ferruginous, according to circumstances. 2d. Chalk or Carbonate of Lime. 3d. Strong or English Glue. 4th. The Pulp of Paper. 5th. Linseed Oil.

The bolar earth and the carbonate of lime are reduced to powder separately, in a mortar, and passed through a silken sieve.

The glue is dissolved in water, in the usual manner.

The paper pulp employed is such as is known by the paper-makers, under the name of common paper pulp, (*papier bulle*). This is steeped in water, and the water afterwards extracted from it by means of a press. Instead of this pulp, we may employ with advantage the waste of white paper, or book-binders' cuttings; these must be boiled for twenty-four hours, and the water squeezed out by means of a press.

The linseed-oil employed must be raw.

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[*] From the *Dictionnaire Technologique.*

The mass of paper being mixed in a mortar, with the dissolved glue, is made into a paste, by adding the bolar earth and carbonate of lime. The whole being well beaten together in the mortar, the linseed-oil is poured in from time to time, as fast as it can imbibe it. They then take a quantity of this mixture, and spread it with a spatula on a plank or board furnished with a ledge or border, to determine the thickness of the layer;—before this is laid on, however, the plank is covered with a leaf of common paper. They then place upon this mixture another leaf of paper, on which they lay another plank, and reverse the whole: they then lift off the bordered plank, together with the first sheet of paper. After this operation, they again reverse the *stone paper*, and lay it upon a plank strewed over with very fine sand by means of a sieve: they then remove the second plank, and the second sheet of paper; leaving the sheet of composition to dry.

These sheets neither crack nor break in drying; but they are liable to become twisted out of shape, and they are seldom smooth, or without lumps on their surface. To remedy these inconveniences, they are passed between the two cylinders of a flatting-mill, which perfectly unites and gives them firmness: they are then submitted for some time to the action of a press, which makes them perfectly straight and even. And, lastly, the two surfaces of each sheet are coated, either with boiled linseed-oil, or linseed-oil rendered drying by a little oxide of lead.

The following are those compositions which have afforded the best results:—

1st. One part of pulp (made from old paper and book-binders' cuttings), half a part of glue, one part of chalk, two of bolar earth, and one part of linseed-oil—form a thin, hard, and very smooth sheet.

2d. One part and a half of paper pulp, one of glue, and one of white bolar earth—produce a sheet very beautiful, hard and uniform.

3d. One part and a half of paper pulp, two of glue, two of white bolar earth, and two of chalk—produce a uniform sheet, as hard as ivory.

4th. With one part of paper pulp, one of glue, three of white bolar earth, and one of linseed-oil, we obtain a beautiful sheet, which has the property of being elastic.

5th. One part of paper pulp, half a part of glue, three parts of white bolar earth, one of chalk, and one and a half of linseed-oil—form a sheet infinitely superior to that obtained by the process No. 4. This substance has also the property of retaining whatever other shape may be given to it. A few grammes of Prussian blue give it a bluish-green tint.

We may substitute with advantage, in place of the carbonate of lime and the bolar earth (of which we have above spoken,) the *carbonated pulverulent lime*, which Fabbreni discovered in Tuscany; of which he manufactured his floating bricks, and to which he gave the name of *fossil farina*. In the year 1800, Faujas discovered in the department of Ardèche, four leagues distant from the banks of the Rhone, a considerable bed of this earth, in a place readily accessible.

This substance is not rare. Brongniart assures us that it is found, in a layer of a centimetre in thickness, on the lower or lateral surfaces of beds of coarse carbonate of lime. It is frequently found in the environs of Paris, but more particularly in the quarries of Nantz. This earth is white, as light as cotton, and is reduced to powder by the least pressure.

The various experiments made on these sheets of stone-paper, or artificial slates, have proved:—1st. That by a continued steeping in cold water for four months successively, they did not in the least change, nor increase in weight. 2dly. That on being exposed to a violent heat for five minutes, they were scarcely altered in form; but were converted into black and very hard plates: they merely appeared blackened, and somewhat scorched. They constructed a house of wood at Carlscroon, which was entirely covered and lined with these articles; they then filled it with combustibles, and set fire to it: the house resisted the action of the flames.—The experiment was repeated at Berlin, and with the same success.

The materials fit for making this stone-paper are to be found in all parts of the globe. The process is simple, and it requires only very facile manipulations: it may be used, with economy, for covering houses, instead of slates; and for which purpose its lightness renders it far preferable. In this case, it is secured, in large leaves, by copper nails, and the joints filled with cement. The whole being coated with an oil-colour, forms the lightest covering, and one the least penetrable by water.

The cement which we recommend for filling the joints between these sheets after being nailed on, is composed of linseed-oil rendered drying, white-lead and chalk, intimately mixed, and used in a nearly fluid state, in order that the composition may the better insinuate itself amongst the joints and interstices, and cover the heads of the nails.

We have seen, in the Exhibition at the Louvre, in the year 1819, the *stone-paper* invented by *M. Hirsch*, which is white, and possessed of all the properties of the composition described in No. 4. This artist kept his process secret; but we believe it to be the same as is employed in Sweden—as that discovered by M. Géorgi, and which we have here described. L.

ENGLISH PATENTS.

To James Rowbotham, *of the County of Surrey, and* Robert Lloyd, *of the County of Middlesex, Hatters, for their having Invented a certain Method of Preparing, or Putting together, certain Materials, Substances, or Things, for the purpose of being made into Hats, Caps, Bonnets, Cloaks, Coats, Trowsers, and for Wearing Apparel in general, and various other purposes.*

The material proposed by the patentees, to be employed for the foundations of hats, and for various other purposes, is cork; which is to be sliced into thin sheets, by means of a machine similar to those used for splitting leather; or it may be prepared by an ordinary knife, or by various other means, to which processes the patentees lay no claim.

The cork to be employed for the above purposes, is to be reduced into very thin sheets, from about an eighth of an inch to a sixteenth of an inch in substance, and out of these sheets of cork, the shapes, that is, the foundations of the crowns and tips of hats, caps, &c. are to be made; which after being properly connected at the joints are to be covered with shaggy or plush silks, such as are commonly employed for the covering of hats.

The advantages of these cork foundations, are, that the hats made of them are extremely light and flexible, are perfectly water-proof, and from the porosity of the cork, allow the vapour arising from the perspiration of the head to escape through the hat; which will be found to afford great relief to the wearer when walking, and in warm weather.

The patentees propose, not only to employ cork in the thin sheets described above, but also to cut it into narrow strips, and unite the strips together by weaving it in a loom. These strips must be reduced very thin in substance, but may be cut to any breadth that may be deemed desirable or convenient. A warp of flax, cotton or other threads or yarns, is then to be laid in a loom, in the way practised in ordinary weaving; and the warp being opened by headles or otherwise as usual, the strips of cork are to be successively introduced as weft or shoot, in the manner that wires are introduced in weaving pile, and such kind of fabrics; the beating up being performed also in the common manner by the batten.

The materials thus woven, form a sort of cork cloth, which it is intended to cut out into the forms of parts of garments, and to attach these portions of the cloth together in any convenient way, for making them into cloaks, trowsers, and other things, which the patentees state, will be water-proof, warm, and light; and consider that these cork garments will be particularly desirable for sea-faring people, as they will effectually prevent the wearer from sinking in water.

Cork prepared by slicing into thin sheets, may be employed for a variety of other purposes, beside those above stated, particularly for coating damp walls, previously to papering them, and also for the sheathing of ships' bottoms; which objects come within the contemplation of the patentees, and are therefore claimed by them as their invention.—Enrolled October, 1826. [*Newton's Journal.*

To JOSEPH CLISELD DANIELL, *of Stoke, in the County of Wilts, Clothier, for his Invention of certain Improvements in Machinery, applicable to the weaving of Woollen Cloth.*

THE improvements proposed by the patentee apply to what are usually denominated power-looms, that is, looms which are actuated by the power of steam or water. There are two objects intended to be accomplished by these improvements; first, a more powerful beating up of the weft or shoot in weaving woollen cloths, than has hitherto been effected in power looms; and secondly, a mode of lifting the warp, or chain as it is called, so as to throw a much greater portion than usual of the weft, or shoot, on to the face of the cloth; for the purpose of increasing the quantity of pile, and thereby improving the appearance of the cloth when finished.

The beating up of the weft, which in ordinary looms is produced by the hand of the weaver, who brings the lay forward with two smart strokes, which strike the reed against the weft thread, is, in the present improved loom, effected by means of a spring or springs attached to the breast beam, and to the lower bar of the lay.

The movements of the loom are produced by rotatory wheels with cams or tappets acting upon the different parts of the machinery, as may be seen by reference to several patent power-looms. The present patentee, however, does not claim the modes of moving the operative parts of the loom, but simply under this head, the spring or springs, for drawing the lay forward, with considerable force.

In order however, to explain this invention, it is necessary to say, that immediately beneath the lay, there is a rotatory cam, which as it revolves, acts against a piece extending from the under part of the lay, and by that means, forces the lay back, and retains it in that position while the shuttle is passing across, between the threads of the warp. As soon as the shuttle has passed, the cam escapes from the lay, and allows the spring connected to the lay, and to the breast beam, to pull the lay forward with considerable force, which causes the reed to beat up the weft as above said.

Various kinds of springs may be employed for this purpose, provided they are so placed as to draw the lay toward the breast beam.

A long blade spring is proposed, which is made fast to the breast beam at one end, and is attached to the lay near the middle, by a swivel joint; or, instead of being immediately attached to the lay, two other blade springs may be affixed to the lower bar of the lay, and these attached to the acting end of the former, which it is considered would soften the beating up stroke, and yet give all the required force. Or instead of these blade springs, helical wire springs might be employed, one end of the spring being secured to the breast beam, and the other to the lay.

The improved mode of lifting the warp, is by the employment of three headles as the harness, one third of the warp threads being tied up by each headle, and these being made to rise one at a time in succession by the movements of the machinery, previously to every throw of the shuttle, cause only one third of the warp threads to be above the weft, while two thirds are always below it. By this arrangement a greater portion of the weft is thrown on to the surface of the cloth on the right side, and the means afforded of drawing out a larger quantity of pile, which greatly improves the face of the cloth, when the gigging, shearing, and dressing, have been completed. —Enrolled April, 1826. [*Ib.*

To John Frederick Smith, *Esq. of Dunstan Hall, Chesterfield, in the County of Derby, for his Invention of certain Improvements in Machinery, for Drawing, Roving, Spinning, and Doubling Cotton, Wool, and other fibrous substances.*

The subjects described in this specification, are a can with two moveable ends, and a bobbin composed of several pieces which take apart.

As respects the can, it is a cylindrical vessel of tin, of the kind usually employed for receiving the rovings of cotton, &c. from the machines: and the peculiar novel feature is, that both the ends of the can are made capable of being removed, instead of one end only as usual, by the ends having rims which fit into the cylinder, like the lid of a tin saucepan. These ends the patentee calls false bottoms.

The bobbins are made by sliding one tube of metal within another, similarly to the tubes of a telescope, the outer tube forming the barrel of the bobbin, and one of the ends sliding on, and off, in the same way.

These are the improvements in machinery for drawing, roving, spinning, &c. which constitute the subjects of the present patent, and the claims of the patentee to novelty of invention are—"1st. A can for drawing and roving with two false bottoms fitting equally into each end; one of the said bottoms being removed during the process of roving the fibrous substances in the can." The ingenuity of this part of the invention being shown, the reader is left to discover its utility by the exercise of his own imagination. The second claim is "a bobbin made of several parts, in such manner as to be capable of being taken to pieces, after any fibrous substance has been wound upon it, and entirely withdrawn from the said fibrous substance without disturbing the arrangement which was given to such fibrous substances upon the bobbin."—Enrolled December, 1825. [*Ib.*]

To Edward Sheppard, *of Uley, in the County of Gloucester, Clothier, and* Alfred Flint, *of the same place, Engineer, for their new Invented series of Improvements in Machinery, for Raising the Wool, or Pile, on Woollen or other Cloths, by Points; by which the process is much facilitated, and a great saving effected; and part of which Improvements are also applicable to Brushing, Smoothing, and Dressing such Cloths, to the great benefit of the Public.*

The first object of the patentee, is to economize the use of teasels, employed in raising the pile of cloth, as they consider that by the ordinary mode of using teasels, they are worn out and destroyed, much sooner than they ought to be, and consequently increase the expenses of the manufacturer. Instead, therefore, of setting the teasels in flat frames, and fixing these frames on to the peripheries of large cylinders, as in all the gigging machines hitherto used, (and by which the teasels become crusted or worn on one side,) it is proposed to set the teasels in cylinders of small diameter, so that their rotation shall approximate nearer to the figure of the teasel, and consequently bring a greater portion of the surface of the teasel into operation.

There are various modes suggested, of setting the teasels in their frames, one of which is, by means of parallel plates, perforated with holes, through which holes, portions of the teasels are intended to protrude. When one part of each teasel has become worn by use, the confining plate is to be removed, and the positions of all the teasels changed, by the finger and thumb, so as to bring other parts into operation. Small pegs may be set into the periphery of the gig cylinder, and a teasel stuck upon each; or small spindles may be disposed over the surface of the cylinders, their ends being confined between parallel plates, upon which spindles, as axles, the teasels may be respectively mounted, and enabled to turn round. The teasels, must, in that case, be set in oblique rows, in order that they may be turned by the transversing of the cloth, which will prevent the cloth from being streaked, by bringing all parts of the teasels into action.

Another object proposed by the patentees, is to enable the teasels which have become spent by use, to be removed from the gig cylinder, and fresh ones introduced in their place, without suspending the operations of the machine. For this purpose, it is intended to adapt several gig cylinders to one machine, and to mount them upon arms extending from a common centre, or in rings, or by any other contrivance, so as to bring one cylinder at a time into action, and when that has worked long enough to have exhausted its teasels, then bring the next cylinder into action, by turning the frame; the former cylinder being in a situation to have its teasels replenished ready for future use, without having stopped the movements of the machine.

Between the several cylinders, breast boards, or rollers are to be introduced, for the purpose of regulating the pressure of the cloth upon the gig cylinders, and these are to be made adjustable; they are to have oblique ridges and grooves cut in them, for the purpose of keeping the cloth extended.

Brushing cylinders made with hairs or bristles, are to be placed within the machine, for cleaning the teasels; and other brushing cylinders are also to be adapted to the machine, for laying the pile of the cloth. Heated metal cylinders are to be employed, in connexion with the gig machine, for fixing the nap, and these are to be heated by steam admitted through hollow axles to their interior. Steam boxes are likewise to be employed, for drying the spent teasels.

There are no drawings attached to this specification, by which the intended constructions of the above described apparatus might be pointed out, which is the more to be regretted, as we perceive several features mentioned as claimed which have been embraced by former patentees, or commonly practised by cloth manufacturers.—Enrolled May, 1825. [*Ib.*

Some further account of Ledsam's new Method, of Purifying Coal Gas.

The new mode of purifying coal gas, for illumination, mentioned in our last as the invention of Mr. Ledsam, appearing to possess considerable claims upon public attention, we have endeavoured to obtain some further information relative to the process, and in the absence of the specification, which is not yet enrolled, we beg to lay before our readers a few remarks connected with the subject, and a brief statement of the general features of the process, as well as we have been able to collect them.

Nearly thirty years have elapsed since the practical introduction of gas-lights, and it must be admitted that many ingenious and most important improvements have been suggested and adopted, in its production, from time to time, in proportion as it has been brought into more extensive use; but whilst the astonishing discoveries in chemistry, during the same period, have been successfully applied to so many operations connected with manufactures and the arts, it is a very singular fact that the purification of coal gas, which is obviously a chemical process, is at present conducted, nearly, as it was fifteen years ago.

In the infancy of its application to useful purposes, the simple passage of the gas through water, was considered a sufficient purification. In 1810, Mr. B. Cook, of Birmingham, recommended the use of lime-water; and although many patents have since been granted for newer methods, several of the largest gas companies have actually returned either to this old plan, or to some modification of it. Indeed, lime, in different states of humidity, or in solution, is universally employed. It is found, however, generally to be inconvenient for the purpose, as well on account of the large quantities required, as of the expense and labour attending its application, and not less on account of the nuisance and bulk of the refuse lime. In the largest works ten tons per day are thus consumed, and even the aid of a steam-engine, is necessary to agitate the solution.

As the efficacy of lime as a purifier depends chiefly on its alkaline properties, attempts have been made to introduce as substitutes for it, potash and soda; both of which are decidedly superior to lime, but the expense attending their use has hitherto prevented their adoption. This objection, however, cannot be urged against the volatile alkali, ammonia, which may be readily procured in ample quantity in all gas works, from the liquor deposited in the hydraulic main; and, when properly prepared, which may be done at a trifling expense, it becomes not only a better purifier, but is also very considerably cheaper than lime.

The following is a brief sketch of Mr. Ledsam's process:—In the first place, a quantity of the ammoniacal liquor is saturated with muriatic acid. It is then reduced by evaporation, until it will crystallize on cooling. A portion of the crude muriate of ammonia thus obtained, is mixed with about two-thirds its weight of quick-lime, and put into a retort, over a moderate fire. From this retort a copious stream of ammoniacal gas is given out, and is brought into contact and mixture with the coal gas, which is chemically acted upon and deprived of its impurities; after which it is passed through a vessel of water wherein the ammonia is retained, and whence *it may be re-produced for future use.* The muriate of lime, remaining in the retort after each operation, will serve instead of muriatic acid, to convert fresh quantities of ammoniacal liquor, to the state of muriate of ammonia.

The apparatus is simple and not expensive, and the principle may be immediately applied where the wet-lime system is in use. The materials are two-thirds less expensive, and not one hundredth part of the bulk of lime. The attendance on the largest work will not employ more than one man. The quantity of gas is greater than usual. The operation may be conducted in the open air, and the cost of purifying may be estimated at about three half-pence per thousand feet, exclusive of the patent right. [*Ib.*

Account of a New Phenomenon observed in the emission of Steam, and one which affects the ordinary Safety Valve. By M. Clement.

M. Clement has communicated to the Royal Academy of Science in Paris, some singular results observed by him, connected with steam. When steam is greatly compressed in a boiler, so that a strong current is made to blow out through a small orifice, a metal plate, or disc, being presented at a little distance from the orifice, is forcibly repulsed; but if it be brought near, and pressed, so as nearly to close the orifice, and cause the steam to escape in a star form, or radient direction, round the outside of the disc, an external pressure will be found to act upon the disc, and it can only be set at liberty by forcibly raising it.

If the aperture of the steam vessel be directed towards the earth, the disc, notwithstanding the downward pressure of the steam is added to its own gravity, will not fall, but remain suspended; and force must be employed to make it quit its position. The same result takes place, if the experiment be made with the strong wind of the bellows of a smith's forge.

In the first experiment, M. Clement ascertained that valves of ordinary strength, which are true discs, placed upon the orifices of boilers, present danger inherent in their form. When they are only lifted just enough to let a thin sheet of vapour escape from the aperture, it becomes impossible to raise them any more by the force of the steam; and if the production of steam be too rapid to be discharged by this small opening, and the strength of the copper be unequal to resist its force, an explosion will take place, though the valves are partially open. This, though it has been thought incredible, is what has really happened.

M. Clement says, that time does not permit him to explain the discovery he has made of these singular phenomena; it is only known that he attributes them to a vacuum, which is formed in the steam at very high pressure, in consequence of the great swiftness of its molecules; and by the conical form of the tube, through which the vapour is passed, causing it to dilate itself towards the edge, much below the atmospheric pressure; the force of the atmosphere is thus enabled to act with sufficient strength on the moveable disc, to enable it to resist the vapour.

Security against danger, in this experiment, depends on taking care that there should be a sufficient distance between the openings and the edges of the disc. It is necessary that the first should be large, and the other small, otherwise the employment of a conical tube to the valve, would diminish the effect of the atmospheric pressure.

M. Clement is of opinion, that some length of experience will be necessary to become acquainted with the best mode of making secure valves, capable of preventing the danger to which he has alluded; and he strongly recommends that experiments should be made, keeping in mind the hints which he has given. [*Ib.*

NATURAL HISTORY.

THE BEAVER.

From vol. 2 of "American Natural History."* By John D. Godman, M. D. Professor of Anatomy in Rutger's College, N. Y. &c. &c.

Castor Fiber: L. Erxl. &c.

Le Castor, ou le Biévre: Briss. Regn. An. p. 133.

Le Castor: Buff. viii. pl. 36.

Castor Fiber: Sabine, App. p. 659. Say, Long's Exped. to the Rocky Mountains, vi. p. 464.

Truth, alike the object, and reward, of all rational inquiry, is too delicate and unobtrusive to be advantageously approached or estimated, unless the mental vision be entirely free from prejudice, and her votaries, for the sake of her unostentatious, though unfading charms, forego the pride of worshipping the fantastic creatures of their own imaginations. Accessible to all, who in the proper disposition seek her presence, how many ages have elapsed, during which fiction has been pursued in her stead, till at length opinion gains such strength, and prejudice so deep a root, that the semblance passes into general acceptation for the substance, and that which was at first the mere breath of speculation, becomes finally received, and accredited, as indubitable. Thankless is the office of the individual who ventures to overturn any of these *idols* of the mind; to displace the illusions of fancy, by cold reality, and disperse into thin air, the fairy world which credulity first called into existence, and indolent imagination perpetuates. It must be confessed, that occasionally, this is no pleasant task; yet it is one of the duties especially incumbent on the teacher of natural history, inasmuch as the exercise of imagination is always prejudicial to the study of nature; the sober reality of which, when correctly examined, possesses an interest for transcending that of all fugitive beauties bestowed by this deluding faculty of the mind.

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* Just Published by Carey, Lea and Carey, of this city.

Who has not heard of the wonderful sagacity of the *beaver*, or listened to the laboured accounts of its social and rational nature? Who that has read the impassioned eloquence of Buffon, to which, nothing is wanting but truth, in order to render it sublime, can forget the impression which his views of the economy and character of this species produced? The enchanter waves his wand, and converts animals, congregated by instinct alone, and guided by no moral influence, into social, rational, and intelligent beings, superior to beings high above them in organization, and even far more exalted than vast tribes of that race which has been justly and emphatically termed "lords of the creation." Alas, for all these air-drawn prospects! while we endeavour to gaze upon their beauties they fleet away, and leave no trace behind.

The injury the mind receives from this source is scarcely to be appreciated, and among others, the false notions we form concerning the relative perfection and excellence of the plan of nature, may be considered as of the first magnitude. The beaver, for instance, is endowed with singular instincts, and performs actions worthy of our admiration; yet the beaver is not more sagacious than the ant, or the bee, creatures far removed from it in every respect; neither are its moral qualities better than those of the common rat. Each according to its instinct, provides for the safety and support of itself and its offspring, each obeys the impulse of a power beyond its own control, and each remains through countless generations, the same in point of intelligence;—untaught, incapable of teaching, and as well qualified to perform all the singular actions of its predecessors, if removed at the earliest age, from its kind, as if it had grown to maturity in their midst, and aided in their operations from the time its strength became sufficient to the task.

After rejecting the exaggerated facts, as well as the numerous fictions, relative to this animal, ample scope will still remain for the exercise of our admiration; for although the beaver is in no respect exclusively wonderful, yet its character and habits are such as to render it highly interesting. We shall, therefore, give a plain, unvarnished statement of facts, obtained from the most authentic sources, and afterwards present some sketches of what, although frequently repeated in books of acknowledged authority, may be termed the *fabulous history* of the animal. This will prove serviceable as well as amusing, as it will lead the inexperienced to receive wonderful narrations of the intelligence, &c. of animals, with enough of scepticism to prevent them from being betrayed into error.

The general aspect of the beaver, at first view, would remind one of a very large rat, and seen at a little distance it might be readily mistaken for the common musk-rat: but the greater size of the beaver, the thickness and breadth of its head, and its horizontally flattened, broad, and scaly, tail, render it impossible to mistake it for any other creature, when closely examined. In its movements, both on shore and in the water, it also closely resembles the musk-rat, having the same quick step, and swimming with great vigour and celerity, either on the surface, or in the depths of the water.

In a state of captivity, or insulation, the beaver is a quiet, or rather, a stupid animal, evincing about as much intelligence as a tamed badger, or any other quadruped which can learn to distinguish its feeder, come when called, or grow familiar with the inmates of the house where it is kept. It is only in a state of nature, that the beaver displays any of those singular modes of acting, which have so long rendered the species celebrated: these may be summed up in a statement of the manner in which they secure a sufficient depth of water to prevent it from being frozen to the bottom, and their mode of constructing the huts in which they pass the winter.

They are not particular in the site they select for the establishment of their dwellings, but if it be a lake or pond where a dam is not required, they are careful to build where the wâter is sufficiently deep. In standing water, however, they have not the advantage afforded by a current for the transportation of their supplies of wood, which, when they build on a running stream, is always cut higher up than the place of their residence, and floated down.

The materials used for the construction of their dams, are the trunks and branches of small birch, mulberry, willow, poplar, &c. They begin to cut down their timber for building early in the summer, but their edifices are not commenced until about the middle or latter part of August, and are not completed until the beginning of the cold season. The strength of their teeth and their perseverance in this work may be fairly estimated by the size of the trees they cut down. Dr. Best informs us that he has seen a mulberry tree, eight inches in diameter, which had been gnawed down by the beaver. We were shown, while on the banks of the Little Miami river, several stumps of trees, of at least five or six inches in diameter, which had evidently been felled by these animals. These are cut in such a manner as to fall into the water, and then floated towards the site of the dam or dwellings. Small shrubs, &c. cut at a distance from the water, they drag with their teeth to the stream, and then launch and tow them to the place of deposit. At a short distance above a beaver-dam, the number of trees which have been cut down appears truly surprising, and the regularity of the stumps which are left might lead persons unacquainted with the habits of our animal, to believe that the clearing was the result of human industry.

The figure of the dam varies according to circumstances. Should the current be very gentle, the dam is carried nearly straight across; but when the stream is swiftly flowing, it is uniformly made with a considerable curve, having the convex part opposed to the current. Along with the trunks and branches of trees they intermingle mud and stones, to give greater security, and when dams have been long undisturbed and frequently repaired, they acquire great solidity, and their power of resisting the pressure of water and ice is greatly increased by the willow, birch, &c. occasionally taking root, and eventually growing up into something of a regular hedge. The materials used in constructing the dams, are secured solely by the resting of the branches, &c. against the bottom, and the subsequent accumulation of mud and stones, by the force of the stream or by the industry of the beavers. In various parts of the western country, where beavers are at present entirely unknown, except by tradition, the dams constructed by their labours are still standing securely, and in many instances serve instead of bridges to the streams they obstruct. There are few states in the Union in which some remembrance of this animal is not preserved by such names as *Beaver-Dam*, *Beaver-Lake*, *Beaver-Falls*, *&c.*

The dwellings of the beaver are formed of the same materials as their dams, and are very rude, though strong, and adapted in size to the number of their inhabitants. These are seldom more than four old, and six or eight young, ones. Double that number have been occasionally found in one of the lodges, though this is by no means a very common occurrence.

When building their houses, they place most of the wood crosswise, and nearly horizontally, observing no other order than that of leaving a cavity in the middle. Branches which project inward, are cut off with their teeth, and thrown among the rest. The houses are by no means built of sticks first and then plastered, but all the materials, sticks, mud and stones, if the latter can be procured, are mixed up together, and this composition is employed from the foundation to the summit. The mud is obtained from the adjacent banks, or bottom of the stream, or pond, near the door of the hut. Mud and stones, the beaver always carries, by holding them between his fore paws and his throat.

Their work is all performed at night, and with much expedition. When straw or grass is mingled with the mud used by them in building, it is an accidental circumstance, owing to the nature of the spot whence the latter was taken. As soon as any part of the material is placed, where it is intended to remain, they turn round and give it a smart blow with the tail. The same sort of blow is struck by them upon the surface of the water, when they are in the act of diving.

The outside of the hut is covered, or plastered, with mud, late in the autumn, and after frost has begun to appear. By freezing, it soon becomes almost as hard as stone, effectually excluding their great enemy, the wolverene, during the winter.—Their habit of walking over the work frequently, during its progress, has led to the absurd idea of their using the tail as a trowel. The habit of flapping with the tail is retained by them in a state of captivity, and, unless it be in the acts already mentioned, appears designed to effect no particular purpose. The houses, when they have stood for some time, and been kept in repair, become so firm from the consolidation of all the materials, as to require great exertion and the use of the ice-chisel or other iron instruments to be broken open. The laborious nature of such an undertaking may easily be conceived, when it is known that the tops of the houses are generally from four to six feet thick at the apex of the cone. Hearne relates having seen one instance in which the crown or roof of the hut was more than eight feet in thickness.

The door or hole leading into the beaver-hut, is always on the side farthest from the land, and is near the foundation of the house, or at a considerable depth under water. This is the only opening into the hut.

The large houses are sometimes found to have projections of the main building thrown out, the better to support the roof, and this circumstance has led to all the stories of the different chambers, or apartments, in beaver-huts. But these larger edifices, so far from having several apartments, are either double or treble houses, each part having no communication with the other, except by water. Upwards of twelve such dwellings have been seen under one roof, and, excepting two or three of them, the whole of the remainder had no communication unless by water, each having its own door into the dam, which is doubtless well known to the inmates, who may have comparatively little intercourse with each other. It is a fact, that the musk-rat is sometimes found to have taken up his abode in the huts of the beaver; the otter also occasionally intrudes his company. The latter animal, however, is a dangerous guest, for if provision grow scarce, it is not uncommon for him to devour his host.

The northern Indians believe, that the beavers always thicken the northern walls of their houses much more than the others, in order more effectually to resist the cold. In consequence of this belief, these Indians always break into the huts from the south side.

All the beavers of a community do not co-operate in the fabrication of houses for the common use of the whole. Those which are to live together in the same hut, labour together in its construction, and the only affair in which all seem to have a joint interest, and upon which they labour in concert, is the dam, as this is designed to keep a sufficient depth of water around all the habitations.

In situations where the beaver is frequently disturbed and pursued, all its singular habits are relinquished, and its mode of living changed, to suit the nature of circumstances, and this occurs even in different parts of the same rivers. Instead of building dams and houses, its only residence is then in the banks of the stream, where it is now forced to make a more extensive excavation, and be content to adopt the manners of a musk-rat. More sagacity is displayed by the beaver in thus accommodating itself to circumstances, than in any other action it performs. Such is the caution which it exercises to guard against detection, that were it not for the removal of small trees, the stumps of which indicate the sort of animal by which they have been cut down, the presence of the beaver would not be suspected in the vicinity. All excursions for the sake of procuring food are made late at night, and if it pass from one hole to another during the day time, it swims so far under water as not to excite the least suspicion of the presence of such a voyager. On many parts of the Mississippi and Missouri, where the beaver formerly built houses according to the mode above described, no such works are at present to be found, although beaver are still to be trapped in those localities. The same circumstances have been remarked of the European beaver, which has been thought to belong to another species, because it does not build. This, however, as may readily be inferred from what we have just stated, is no test of difference of species.

These animals also have excavations in the adjacent banks, at rather regular distances from each other, which have been called *washes*. These excavations are so enlarged within, that the beaver can raise his head above water in order to breathe without being seen, and when disturbed at their huts, they immediately make way under water to these washes for greater security, where they are more readily taken by the hunters, as we shall presently discover.

The beaver feeds, principally, upon the bark of the aspen, willow, birch, poplar, and, occasionally the alder, but it rarely resorts to the pine tribe, unless from severe necessity. They provide a stock of wood from the trees mentioned, during the summer season, and place it in the water opposite the entrance to their houses. They also depend in a great degree upon the large roots (of the *nuphar luteum*,) which grow at the bottom of the lakes, ponds, and rivers, and may be procured at all seasons. It is remarked that these roots, although they fatten the beaver very much, impart a rank and disagreeable taste to its flesh.

The number of young produced by the beaver at a litter, is from two to five. Females have been killed in which six young were found, but this occurred only in two instances out of many hundreds examined at different stages of gestation.* During the season of union, the voice of both sexes resembles a groan, the male having a much hoarser note than the female. The young beavers whine in such a manner as closely to imitate the cry of a child. Like the young of most other animals they are very playful, and their movements are peculiarly interesting, as may be seen by the following anecdote, related in the narrative of Capt. Franklin's perilous journey to the shores of the Arctic Sea.—" One day a gentleman, long resident in the Hudson's bay country, espied five young beavers sporting in the water, leaping upon the trunk of a tree, pushing one another off, and playing a thousand interesting tricks. He approached softly, under cover of the bushes, and prepared to fire on the unsuspecting creatures, but a nearer approach discovered to him such a similitude betwixt their gestures and the infantile caresses of his own children, that he threw aside his gun and left them unmolested."

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* Hearne.

[TO BE CONTINUED.]

Animadversions on MR. GENET'S *Reply, to "Remarks on his Memorial on the Upward forces of Fluids;" with additional Observations on the Merits of that work. By the* EDITOR.

"The baseless fabric of a vision."

OUR readers are reminded, that in our second volume, p. 41, we re-published, from the "Boston Journal of Philosophy and the Arts," a notice of Mr. Genet's Memorial; and to this notice, appended a few remarks of our own. Dr. Pascalis of New York, in the 11th volume of the "American Journal of Science and the Arts," edited by Dr. Silliman, gave an abstract of the "Memorial," accompanied by the plates intended to illustrate the subject; and made a number of vituperative remarks, which elicited some further observations from us, in our number for January last, to which we refer our readers. Mr. Genet, in the 1st and 2d numbers, of the 12th volume of Silliman's Journal, has undertaken to vindicate his "Memorial," and to charge us with ignorance and presumption, on account of the course we had pursued in our notice. All this was exactly what we anticipated, as we had treated the whole scheme as whimsical, unphilosophical, and even ridiculous; and the more we have examined it, the more perfectly have we been convinced, that this was the only treatment which it merited. In the present instance, we shall depart in some degree from this course; which we are induced to do, from the circumstance of its having derived an adventitious importance, in consequence of its publication in one of the first scientific Journals of our country. This "airy nothing," has thus obtained "a local habitation, and a name," which will protect it from that early oblivion, to which it would otherwise have been consigned.

It is conceded, on all hands, that there is a legitimate use of ridicule, and that this weapon is very properly employed against extravagance, fanaticism and presumption, whatever be the subject on which they are manifested; and although it may be impossible for the individual, whose projects are submitted to such an ordeal, to separate himself, from the severities intended for his labours only, yet this distinction ought to be made by others. There is, perhaps, no subject in which the generality of men, otherwise intelligent, manifest so much ignorance, as on that of mechanics; the wildest speculators, have from this cause, obtained the support of gentlemen whose names are authoritative, in consequence of their having been distinguished for their knowledge in the natural sciences, or in other branches not requiring an acquaintance with the principles of mechanics. We also see such men themselves, occasionally run wild upon this subject, either pursuing the phantom, perpetual motion, or other schemes equally at variance with all sound philosophy; and although in this case, we may, at once, pronounce, that they are not mechanical philosophers, still they may be, not only very good, but, on other subjects, very wise men; and merit to be, members of the Institute of France, of the Philosophical Society of New York, or Presidents of the American branch of the Linnæan Society of Paris.

That Mr. Genet should be displeased with our manner of treating his views, is perfectly natural, as he, undoubtedly has the most perfect confidence in them. We really believe that he is as sincere as captain Symmes, and we also think that their theories are equally hollow. The more extravagant, however, the theory, the less likely is its advocate to be convinced of its fallacy; but although the individual may be *incurable*, the spreading of his disease may sometimes be prevented by well applied caustics. Mr. Genet may probably recollect, that about seventeen or eighteen years ago, a number of gentlemen, living in Albany, and some of them very learned men, united to build a boat to be propelled by the motion of a pendulum, urged by the strength of only three or four men. This was to supply the place of a steam engine; a certain Mr. Letton was the proposer of the scheme, and, although our influence was sufficient to save some of our friends, certain intelligent civilians, and other gentlemen of worth and standing, *paid for it*. In the *Athens of America*, sage and wary members of many learned societies, have been fain to hang their harps upon the willows, after having sung the praises of Redheffer's perpetual motion; and without claiming inspiration, we fear not to prophesy, that a similar termination will be witnessed, should the citizens of the *Commercial Emporium*, be induced to become "associates for the essay of a hydronaut."

Mr. Genet has brought against us certain grave charges, some of which shall receive a passing notice; and, although we are not so vain as to expect to succeed in convincing him, that he has himself committed the very error which he ascribes to us, we may perhaps be more fortunate with *impartial judges*. In speaking of the first article in which his work was noticed, he says "but I find, that excepting a few additional acerbities, and ungenteel allusions to my advancing age, the editor has, &c." The following is the only passage to which it is possible he can allude. "We were, however, unwilling to interfere with the whimsies, and to disturb the reveries, of a very respectable man, who, probably, has cherished fond hopes of this child of [his] old age; it was the more unpleasant to us, as we have had some personal knowledge of the gentleman, and have respected him highly." (Vol. 2, p. 44.) Few persons, we apprehend, will find in this language, acerbities, and ungenteel allusions.

In the last number of Silliman's Journal, there are several expressions, which, as they are similar in character, may be grouped together, that a judgment may be formed, whether we might not justly retort, one, at least, of the charges brought against us. "The asperities of my censor, and his unfair subversions, misnomers, and curtailments." "The sneers of Dr. Jones." "Dr. Jones garbles when he says that I call a vacuum a gas." "The denomination of *gaseous* fluids, which I have given to steam, and not to the vacuum, as the Dr. very unfaithfully quotes it." "Less conceited appellate judges," *et cum multis aliis.*

The foregoing charges would be truly formidable, were they not deficient in the essential property, correctness; we have certainly curtailed, because we have not quoted the whole book, but have not either garbled, subverted, or unfaithfully quoted; neither have we intentionally misrepresented the author's meaning, in a single instance.

We will now proceed to notice some of the observations of Mr. Genet, in his last "reply," and will afterwards attempt a short analysis of the principal projects brought forward in the "memorial," which has given rise to this disquisition. Should we call the "submissive philosophy" of Mr. G. into action, it will neither merit or receive our *sneers*, as we shall carefully draw the line between this gentleman, and his schemes; and indeed, were it not for the respectability of the former, the latter would not have received any public notice from us, however they might have served for the amusement of a leisure hour.

Probably, but few of our readers, have seen the "memorial," although many of them will have become acquainted with its leading features, from the communication of his friend Dr. Pascalis, in Vol. 11, p. 339, of Silliman's Journal. This communication contains all the plates which are given in the 'memorial.' They are curiosities, and should be examined by all who have an opportunity to do so. For the sake of those who have not this advantage, we will endeavour, by our extracts, and explanations, to give a view of the subject, sufficiently clear to enable them to judge of the merits of the controversy.

Mr. Genet has, in p. 312, 313, of Silliman's Journal, quoted from the Franklin Journal of January last, our animadversions on his description of the vis motrix of the steam engine; and proceeds through two or three pages, next succeeding, to state the vast amount of information on this subject, which, in the year 1784, he derived from a conversation with its great improver, Mr. Watt; "all which" he says, "is perfectly present to my memory, my mental retentive faculties being preserved by the invigorating exercise of a laborious country life." It must be confessed that the extent of information which he displays, accords with his own history of its attainment, and does great credit to a recollection of between forty and fifty years standing. The very reverse of credit, however, would be due to one who professed to have obtained his knowledge of the engine, from books, and observation, were his information as meagre, as that of our author.

The various errors committed by Mr. Genet, in his attempt to describe the engine, in his memorial, are followed, in his reply, by others equally palpable. It may be said, that although the existence of these errors be admitted, they do not affect the merit of his own inventions; but let it be remembered that this merit is altogether gratuitous; that Mr. G. has attempted to run a parallel between his hydronaut, and the steam engine, without understanding the operation of the latter; and that there is but little probability, that the world will be presented with any of those great discoveries, which involve a long train of reasoning, and correct theoretical, and practical knowledge, by one who has, manifestly, not only forgotten what he must once have known, but who has ceased, for forty years, to keep pace with the improvements in science, and the application of mechanical and chemical principles, to the useful arts. In the race of improvement, the starting point, should be the goal at which others have arrived.

We have asserted that Mr. G. is not acquainted with the structure, and operation, of the steam engine; it is incumbent on us to prove the correctness of this assertion, and unfortunately for this gentleman, he has rendered the task perfectly easy. In his reply p. 316, Mr. Genet, after detailing a portion of the information received from Mr. Watt, says, "None of the subsequent improvements were omitted by Mr. Watt, to show the gradual progress of the steam system of mechanics, and reach his own improvement; *in the first place*, upon the open ended cylinder, in which the expansive force of steam was employed to raise the piston, which in its fall, after the destruction of the steam, as I have stated it, became, under the pressure of the atmosphere on the piston, and the weight of the said piston, the *available force*. *And in the second place*, upon the tight cylinder which is constructed in such a manner, that on one side, instead of the atmosphere, the steam is made to press on the piston, whilst on the other side the cylinder is open to the condenser."

"This summary description of the two different modes of guiding and using the power of steam, improved in succession by Mr. Watt, and which have both their respective advantages and disadvantages, and are both in use, will, I presume, sir, satisfy you and your readers, that, in the critique of the parallel which I have drawn between the operation of the steam-piston in an open cylinder, and my hydrostat, equally placed in an open cylinder, Dr. Jones has proved either his ignorance of the difference between the open ended cylinder, practically called the *atmospheric engine*, and the tight cylinder, called the *double acting engine*, or that he has purposely selected the complicated operation of the double acting engine, in which the pressure of the atmosphere is no more used, or of the high pressure engine, (in which, on account of its overwhelming force, the pressure of the atmosphere is not taken into account, and the cylinder is left open to the air,) for the *unfair* purpose of showing that my parallel was incorrect, and my definition of the steam-engine injudicious. Had he known, or *candidly* considered, that in the open ended cylinder the direct force of the steam goes only to raise the piston, and that the expansive force of that steam being condensed, the vacuum created determines the fall of the piston, under its own weight and the incumbent pressure of the atmosphere, equal, on every square inch of the area of the piston, to 15 pounds, he would not have asserted, 'that the pressure of the atmosphere and the weight of the piston were not necessary to Mr. Watt's engine, and served only to abstract from its power.'"

"There is in reality no pressure of the atmosphere in Mr. Watt's double acting engine, which Dr. Jones has here in view. But if there is none, how can it abstract from its power? And again, if the piston works in the vacuum, as Dr. Jones has told us it did, what difference can its levity or its weight make in its power, if in vacuo, according to Newton, the gravitation of a feather and of a ball of lead, compels them to obey, with the same speed, the proportionate force that draws them towards the centre of the earth?"

Some of those who know us intimately, will smile at the idea of our being charged with ignorance upon the subject of the steam-engine, by one who could write such paragraphs as those just quoted. But let it be kept in mind, that this is from the pen of one who "is not a philosopher of common stamp," a member of several learned societies, and one who has been the pupil and associate of men who have greatly enlarged the boundaries of science, and illuminated the world by their discoveries. Let all this have its proper weight, as it appears to form one of the strongest points, in the argument of our opponent.

Mr. Genet says, that "Dr. Jones has proved either his ignorance of the difference between the open ended cylinder, practically called the *atmospheric engine*, and the tight cylinder, called the double acting engine, or that he has purposely selected the complicated operation of the double acting engine," "for the *unfair* purpose of showing that my parallel was incorrect, and my definition of the steam-engine injudicious." Had this paragraph been written by some injudicious friend to Mr. G. we should have been inclined to have exonerated that gentleman, from the tissue of error which it involves, but it is from his own pen, and must therefore, be treated accordingly. Let us first ascertain who *selected the double acting engine*, as the subject of comparison, for the *unfair* purpose of showing the parallel to be incorrect. In page 61 of his memorial, in the very paragraph in which Mr. Genet runs the parallel, he says, "now let us examine if by mechanical means we can avail ourselves of the upward force of an hydrostat, with as much advantage as Mr. Watt has availed himself of the downward force of the piston, and weight of the steam engine, to procure the rotatory motion so ingeniously and successfully applied by Mr. Fulton, to navigation. But before I avail myself of the hydrostatic power to accomplish that object, as I intend to progress step for step *(pari passu)* in a parallel line with the steam engine, I must first settle a perfect balance of forces between us, and take as a pattern one of the largest boats plying on the Hudson, for example the Chancellor Livingston."

That Mr. Genet supposed the engine on board the Chancellor Livingston, and the other boats on the Hudson, to be acted upon by atmospheric pressure, is evident; and this certainly gives a degree of consistency to remarks, which, without this admission, would be altogether inexplicable. Will Mr. Genet inform us, in what part of the United States, we can see an atmospheric engine? Will he point out any engine, in any part of the world, in which Mr. Watt has availed himself of this power? or "of the downward force of the piston and weight of the steam engine, to procure the rotatory motion?" The fact is, that one of the earliest improvements of Mr. Watt, and one made long before he had constructed the double acting engine, was the abandoning altogether the employment of atmospheric pressure, as a motive power; yet, notwithstanding this fact, which Mr. G. might undoubtedly have learned from many volumes in his own library, hear what he says; "the two different modes of guiding and using the power of steam, improved in succession by Mr. Watt, and which have both their respective advantages and disadvantages, and are both in use, &c." I do not suspect that this is "*unfair*" on the part of Mr. G., or that he has intended to deceive, but I certainly do think, that he "has proved his ignorance of the difference between the open ended cylinder, practically called the *atmospheric engine*, and the tight cylinder, called the *double acting engine*;" and also, that he is entirely ignorant of the structure of Watt's single acting engine, which requires a tight cylinder; that is, a cylinder closed at top, with the piston rod passing through a stuffing box, just as in the double engine. We presume that Mr. G. once understood the action of the old atmospheric engine, but if he did, he has now forgotten it. His description of this, is equally incorrect, with his account of those of Mr. Watt; when attempting to show our *ignorance*, or want of *candour* he says, (reply, p. 316,) "Had he known or candidly considered that in the open ended cylinder, the direct force of the steam goes only to raise the piston, and that the expansive force of that steam being condensed, the vacuum created determines the fall of the piston under its own weight, and the incumbent pressure of the atmosphere, equal on every square inch of the piston, to 15 pounds, he would not have asserted 'that the pressure of the atmosphere and the weight of the piston, were not necessary to Mr. Watt's engine, and served only to abstract from its power.'" Certainly, we did not *know* all these things, and *candidly*, or rather, confidently aver, that they are not facts. Had this description of the engine been intended as a travestie, its success would have been perfect. We scarcely know, how any one could contrive to thread a greater number of errors, on a string of the same length. The *direct force of the steam, does not go to raise the piston;* the steam merely balances the pressure of the atmosphere, and the piston is raised by a weight suspended to the opposite end of the beam, which weight is considerably heavier than the piston itself. The piston does *not* "fall under its own weight, and the incumbent weight of the atmosphere," but, on the contrary, a considerable portion of the pressure of the atmosphere, is expended in raising the heavy counterpoise of the piston. The critique which follows, serves fully to confirm this gentleman's want of information, upon the subject which he undertakes to discuss. "There is" he says, "in reality, no pressure of the atmosphere in Mr. Watt's double acting engine, which Dr. Jones has here in view, but if there is none, how can it abstract from its power? and again, if the piston works in the vacuum, as Dr. Jones has told us it did, what difference can its levity or its weight make in its power, if in vacuo, according to Newton, the gravitation of a feather and of a ball of lead, compels them to obey with the same speed, the proportionate force that draws them towards the centre of the earth?" Here, by fair inference, the fallacy that the pressure of the atmosphere, operates in Watt's single acting engine, is repeated. We are also asked "how the air of the atmosphere, can abstract from its power?" Will not the air pump, which is absolutely necessary to its action, and which consumes no inconsiderable portion of the power of the engine, answer this question? Has not Mr. G. answered it in the following quotation from the very page, on which he makes the inquiry? "a perfect vacuum cannot be procured; the air that remains, or that is formed in the cylinder after the condensation, or the air which enters the steam vessels, with the condensing water, and the gas, air, or steam, which forces itself between the piston and the sides of the steam vessels, let the collar through which the piston rod must work, be made ever so tight, and close, cannot be drawn out, or excluded entirely, and will always, in all kinds of engines, oppose a gradual decrement to the descending power of the piston."

The philosophy of the question respecting the fall of bodies in vacuo, is much more modern than that of Newton, or of any other philosopher with whom we are acquainted, with the exception of Mr. G.—Newton never confounded together, momentum and velocity, but taught that the former was compounded of velocity and quantity of matter. Where, in his Principia, his Optics, or any other of his works, has he said that a feather, and a large mass of metal, such as the piston of a steam-engine, would weigh alike, or descend with the same force, in vacuo? Really, there is in this world, more than one person, who might derive information by being "condemned to study again, his experimental, and mechanical philosophy."

"Dr. Jones *garbles*, when he says that I call a *vacuum a gas*, and the *vapour of water atmospheric*." We quoted the whole sentence, in Mr. Genet's own words, and if this be to garble, we do not understand the meaning of the word. Where an opinion is obscurely expressed, we might misinterpret, and in this case we should wish to be corrected. The following is the paragraph to which Mr. G. alludes. "How does the steam engine perform that operation; how does it create that *vis motrix*, that moving force, which is the mechanical life of the machine? By the alternate increase and decrease of temperature, which produces in the cylinder two kinds of fluids, the one gaseous, the other atmospheric, by means of which the piston rises and falls." Now it so happens that when the engine is in operation, there is a vacuum on one side of its piston, and steam on the other; it follows, therefore, that if Mr. G. does not call a *vacuum a gas*, and the *vapour of water atmospheric*, he, of course, calls *the vacuum atmospheric*, and the *vapour of water a gas;* and from his explanation it appears that the latter was his meaning; but as we were not then aware that he supposed all steam-engines to be atmospheric, we were unable to construe him correctly. It is, certainly, very "clear that atmospheric air itself is a gas," and assuredly, we could not suspect, that he who has had *Condorcet*, *Bailly*, *Lavoisier*, *Sage*, and *Brisson*, for his masters in chemistry, mineralogy, and philosophy, and who was the intimate of Watt, and of Priestley, would consider it as a simple gas; but what are Mr. G.'s peculiar views respecting its compound nature, he has not informed us.

We have greatly extended our remarks on the errors in philosophy, and the want of information on the nature of the steam-engine, which Mr. Genet so constantly exhibits. But this prolixity has appeared to be necessary, in consequence of the confidence with which that gentleman has pronounced his opinions; it has also been imperiously called for, by the charge of ignorance which he prefers against us, whilst for himself he claims a competent knowledge, obtained "by frequent observations made on board of our steam-boats, and in our steam-engine manufactories," "on the origin, progress, and improvement of the steam power, and the theory of aeriform fluids;" and declares, (p. 315,) that he obtained, "from Messrs. Watt and Boulton, and particularly from the first, not only the *most extensive information*, on the great improvements which had been made, in applying the gigantic power of steam to almost all the arts, but also on its beginning and history, all which is perfectly present to my memory."

Here are claims to information and knowledge, which ought, surely, to have been amply sufficient, to have sustained him, calm and unmoved, amidst all our "aspersions, unfair subversions, misnomers, and curtailments;" but, it has been an easy, though by no means a pleasant task, to show that these high claims, are preferred by one, whose modicum of knowledge, is limited to the action of the old atmospheric engine, and that even in this, it is altogether imperfect.

[TO BE CONTINUED.]

FOR THE FRANKLIN JOURNAL.

Observations on Centrifugal Force, founded upon the Theory, attempted to be established, in the Essay on Falling Bodies. By THOS. W. BAKEWELL, ESQ.

THE weight of matter has always been taken as a measure of its quantity; but it is only a comparative measure, for a body of a certain weight at one place, may be supposed to lose half its weight when taken to another, by a diminution of gravitating force, or, as at the centre of the earth, where all attractions are balanced, to have no weight; but we cannot therefore say, the body is annihilated, or has ceased to be matter.

As relates to the laws of motion, and attraction of gravitation, I assume as axioms, that "doubling the quantity of matter in a given body, produces the same result as doubling the gravitating force," and that "the inertia of matter is always as the gravitating force."

Inertia is that property in matter, which makes it resist a change either, from rest to motion, from motion to rest, or any change in the *direction* of its motion.

The resistance to change in the direction of its motion, is, "centrifugal force."

If we give a whirling motion to a bullet at the end of a string, and suddenly let go the string, the bullet will fly off in a right line, and at a tangent to the circle described, BUT NOT BY CENTRIFUGAL FORCE.

The centrifugal force, is the resistance given by the bullet to the constantly changing direction of motion in describing a circle, and is expressed by the tension of the string;* but the bullet will not fly off in the direction of the string. If we suppose an object moving in a right line, to be suddenly attracted by a body perpendicularly to its line of motion, and in such force, as should draw the object from its rectilinear motion, so as to describe a circle round the body; and that, when it had arrived at the same point at which the attraction commenced, the attraction should as suddenly cease, the object would then continue its motion in a right line; NOT BY CENTRIFUGAL FORCE, but by the original impulse, which first gave it motion.

The velocity required in bodies, to produce a continued revolution round others, depends on their distances from those bodies: and the proportion that the distances, and velocities, must bear to each other, is, (by Huygens and Newton,) as the cubes of the distances, to the squares of the times of performing the revolutions.

It is perfectly immaterial how great, or small, the gravitating force may be, or how much matter, or weight, may be contained in the object revolving, or in the body round which it revolves; for the attracting power, (gravitating force) and the detracting power, (centrifugal force) are always in the same ratio to each other.

A sphere, is the only solid figure wherein all the lines produced perpendicularly from every part of its surface, towards its centre, would meet in one point. If the earth were once in a fluid state, and the fluid were compressible in its nature, the centre would become the most dense, and the density would regularly decrease, as we approached the surface. A solid body, of greater specific gravity than the fluid at the surface, would sink in it, and continue to sink towards the centre, until it came in contact with some other solid matter, or the fluid, by compression, became of greater specific gravity than itself. Although the earth, on the foregoing supposition, would not be homogeneous, yet, as the deviation therefrom, would be uniform, it might be so considered, as relates to the intensity of gravitation at different parts of its surface. If the earth, in its fluid state, as above supposed, obtained a rotation on its own axis, a centrifugal force would result, and it would cease to remain spherical, and its deviation from a sphere would depend on the velocity of this rotation. The centrifugal force would be nothing at the poles, and no effect would be produced; it would be greatest at the equator, but no effect would be produced as to alteration of shape, but only a lessening of the gravitating force; the centrifugal force acting, always, in a direction parallel to the plane of the orbit described by each part of the earth, and at right angles to the polar axis.

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* The apparent solecism of calling a "force," a "resistance," cannot be avoided. This subject must necessarily abound in them, from the incorrect ideas attached to visible effects.

The intermediate spaces, between the poles, and equator, would be variously affected by the centrifugal force. In latitude 45, where we will suppose it to produce the greatest effect, the operation would, I apprehend, be as follows. The plumb line, before the existence of this centrifugal force, pointed to a common centre, which was perpendicular to the surface of the earth at that place; and consequently, the fluid was on a level, and had no disposition to change its place. The centrifugal force (being the same, in effect, as an attraction of equal force, in a direction parallel to the plane of the equator, and *from* the earth) alters the plumb line, making the surface, at this place, an inclined plane, declining towards the equator. The fluid flows down this plane, and raises the surface at the equator, and by its removal depresses the surface at the poles.

This is the mode of operation at every point, between the poles and the equator, varying only in degree; and the earth would settle to a form, which should, every where, bring the plumb line perpendicular to its surface; in which situation only, as a fluid body, could it remain at rest.

Now the earth has, at present, a fluid surface to such an extent, or has a fluid communication one part with another, sufficiently free, to prove that it *has* taken such a shape, as to preserve its surface at rest; and from these data, the figure of the earth may be determined. (The tides are not overlooked, but they do not affect the question.)

In my communication to the Franklin Journal for July, on "Falling Bodies," I attempted to prove, that the velocity with which matter obeys gravitation, is in all cases the same, without regard to the degree, or force, of the attraction of gravitation; because "the inertia is always as the gravitating force:" so also, is it, with the centrifugal force.

If the earth, by some means, were to become of double its present weight; say by the addition of an equal quantity of matter, to what it now contains; or, what I contend to be the same thing, that the sun's force of attraction should be doubled; the motion in its orbit would not thereby be changed, for the centrifugal, and gravitating forces, would be in the same relation to each other, as they now are; and so with any of the other planets, or their satellites, in respect to them. If the earth were so far annihilated, that its matter and size, were equal only to that of a pin's-head, it would perform its revolution in the same orbit, as regularly as the earth itself now does, and be no more affected by the disturbing causes of the heavenly bodies, than the earth is.

If, however, we suppose the moon to remain unchanged, the pin's-head-earth, would become a satellite to it, from the alteration of the common centre of gravity between them. We will take no further notice of the moon in this case, for it is, astronomically, a component part of the earth, and consider the *pin's-head* on "its own bottom."

If, in the revolution of an object round the sun, the attraction of some of the celestial bodies should act on the object, in a direction in opposition to that of the sun, the attraction would not affect the body in its orbit; for it would be the same as a decrease of weight, or of the gravitating force; and the centrifugal force would be decreased in a like ratio. If an attraction from some body, should exist in conjunction with that of the sun, it would only be an increase of weight, and also of centrifugal force, to resist it. If an attraction existed, at a tangent to its orbit, and in the direction of its motion, the *line of attraction* on the object, would not be directly to the centre of the sun, as before, but would be compounded of the sun's attraction, and that of the attracting body; giving a direction, in proportion to their respective attracting forces; or, in the usual phraseology, "as the quantities of matter directly, and the squares of the distances inversely;" and the line of attraction would, slightly, coincide with its motion in its orbit, LESSENING the centrifugal force, (resistance to change of direction) in so far, as its attraction should coincide with the direction of its motion; increasing its velocity and distance from the sun, until as the object revolved, the three bodies should be brought in a line, from which point, to that where the disturbing body should be brought in *opposition* to the motion of the object in its orbit, the operation would be regularly reversed, leaving the object, in plain language, "as it found it." To what extent these disturbing causes might exist, creating eccentricity in orbits, without losing the orbit entirely, is a problem beyond my ability, or inclination, to solve. The actual state of things, is, however, much within this extent.

Hence we see, in the existence of these laws, how admirably the harmony, and security, of the planetary system, are provided for, and how impossible it is, that it should "go wrong."

Thos. W. Bakewell.

Cincinnati, July 2d, 1827.

On the subject of Falling Bodies, centrifugal force, and their congeners in philosophy, we are decidedly orthodox; nor do we perceive any thing in the reasoning of our correspondent, calculated, in the slightest degree, to cause us to waver on these points: but whilst we claim the privilege to insert, or reject, any communication, as judgment may dictate, we never shall reject an article, merely because we are not believers in the doctrines which it advocates. It is always understood, that an editor is not to be considered as the advocate of the views of his correspondents, nor ought it, in general, to be expected that he should express his dissent from these views; this, in our estimation, would be to establish a censorship, which would be extremely objectionable. Whilst we claim our own rights, we wish to exhibit the utmost liberality, in construing the rights of others.

What we insert, is open to discussion, and those who write with intelligence, on subjects within the purview of our Journal, may always be heard through the medium of its pages. Editor.

Description of a Steam-engine boiler, adapted to the use of Anthracite, or bituminous coal, and particularly applicable to the Locomotive-engine. By S. H. Long, *Colonel of Topographical Engineers.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Having devoted some attention to the subject of a boiler, or steam generator, adapted to the use of mineral coal, both anthracite and bituminous, as fuel for the steam-engine, and especially for the locomotive-engine, I beg leave to submit the result of my investigations in relation thereto; they are comprised in a brief description of the apparatus proposed for the purposes above mentioned, and illustrated by a drawing hastily executed.

The objects in view, are the construction of a boiler, that shall present the largest surface to the action of the heat, with the smallest quantity of water, and such an arrangement of the fire-place, as will subject the fuel to the strongest draught, and at the same time apply the largest proportion of the heat to the production of steam. The manner in which I propose to accomplish these objects, is as follows.

The accompanying figure, (plate 2, fig. 2,) exhibits a vertical section of the boiler. AA, represents a cylinder of any convenient dimensions, formed of sheet-iron $\frac{3}{16}$ or $\frac{1}{4}$ inch in thickness, rivetted in the usual manner, and constituting the exterior of the boiler. B, the head of the boiler, furnished with a *man-hole* and cap, and also with an aperture, through which the steam is to be conveyed to the working cylinder of the engine. C, a conical frustrum with a concave summit, formed of sheet-iron, of the thickness above mentioned, constituting the interior of the boiler, and at the same time serving as a fire-place. The diameter of its base is about two inches less than that of the cylinder A, while that of the summit is about six inches less, so that the thickness of the circular sheet of water contained in the boiler, is one inch only at the bottom, and about three inches at the top of the frustrum, while the depth above the latter does not exceed three inches. The frustrum and cylinder are firmly connected at bottom, by means of a ring, *a*, of cast-iron or other metal, and rivets passing through them respectively. The ring, *a*, must extend below the cylinder and frustrum, far enough to receive a flanch or step, for the support of the grates, *b*, which are to be adjusted to the circular area of the fire-place.

D, the door, 10 or 12 inches in diameter, through which fuel is to be administered. It is formed by means of a sleeve of sheet-iron, firmly rivetted to the cylinder and frustrum, through the sides of which last, is a corresponding perforation, of the same diameter.

E, the flue, constructed in the same manner as the door, and communicating with the chimney.

The flue may be constructed in such a manner as to pass or wind upon the outside of the cylinder, and apply its heat exteriorly to the boiler, and then communicate with the chimney. The boiler may be sheathed on the outside with pine staves, or any other non-conductor.

The dotted line, *w*, represents the surface of the water in the boiler, the space above serving as *steam-room.* The tube through which the water is conveyed into the boiler, may enter the latter, at any convenient point below the surface *w.*

F, represents a prolongation of the ring *a*, adapted to the use of anthracite, which cannot readily be ignited, in contact with a conductor at a low temperature. The depth of the ring should be about one foot. It must be lined with fire-bricks, or lute of suitable thickness, as represented at *f f*, resting upon the grates *g*, or otherwise supported. The fire-place, in this instance, will be situated below the boiler, and included within the ring F. The whole of the heat that may be generated, must ascend through the boiler, and a large portion of it be applied to the production of steam.

The flanch, or step, for the support of the grates, will be circular, and may be inserted within the ring *a*, and sustained by screw bolts or rivets passing through it and the ring, as represented in the figure.

Any number of boilers of the description above given may readily be combined, and made subservient to the production of steam sufficient for the supply of the most powerful engines.

If we assume three feet for the height of the frustrum, 34 inches for its greatest, and 30 inches for its least diameter, (and three feet for the diameter, and 4 feet for the height of the cylinder A,) the surface exposed to the action of the heat will be about 28 square feet, nearly equal to that of a locomotive engine of the ordinary construction, while the weight of water contained in the boiler, will be less than one third of that required for the common cylindrical boiler.

Very respectfully, &c.

S. H. LONG.

Philad. July 4th, 1827.

Description of an Improvement in Clocks, intended to show the day of the Month. By ALEXANDER YOUNG.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—The annexed drawing, represents an improvement in the construction of clocks, by which the day of the month is shown, without the attention that is usually required, to put the hand forward at the end of a short month. After a trial of more than five years, it is found to be a very useful addition, easily made, and applicable to any clock: if you think it worth publishing, you can give it a place in your Journal.

Yours, respectfully,

Alexander Young.

Camden, S. C., June 20th, 1827.

Description.—Fig. 3, plate 2, represents the improved movement. The wheel of 31 teeth for moving the month-hand is in the usual form, only it has a small wheel of 12 teeth on its side, which makes a revolution in 12 months, by having to pass a fixed pin K, as it is carried round by the month wheel; there are pins on its side at F, A, J, S, and N, which limit the motion of a lever, round a screw or centre at B; there is a pin at G, which limits its motion on the other side. The month wheel is moved by a pin C, projecting from a wheel, which, by the motion of the clock, makes a revolution in 24 hours. There is another pin in the same wheel at D, so short that it will pass under the month wheel. At the end of every month, the lever will come in the way of that pin, and if it be held to its greatest distance from the small wheel, by the pin at F, the lever, and wheel, will be moved round a distance equal to three teeth, and cause the month hand to advance 3 days, as will be required at the end of February; if the lever rest on any of the pins A, J, S, or N, it will be two days later in coming to the pin D, which will cause a motion of only one day; but if the arm of the lever fall between two of the pins, it will be 3 days longer out of the way of the pin D, which will move the lever up to G only, where it will remain until the small wheel has been carried round past the pin K, and moved one tooth, and has begun to rise on the other side, when the lever will fall by its own weight towards the small wheel, until it is stopped by one of its pins, which will make it project as much as is required for that particular month.

The dotted lines represent the lever held in different situations, by the pins in the side of the small wheel.

FOR THE FRANKLIN JOURNAL.

Remarks on the kind of boat most suitable for the transportation of coal, &c., on the Schuylkill navigation, and other canals. By James Stott, *Mineral Surveyor.*

Mr. Editor,

I have lately had occasion to visit Mount Carbon, and could not but notice the very defective manner in which the excellent coal there, is brought down the navigation, to the city of Philadelphia; I see three men and one horse, are generally employed to bring a boat of coal, containing twenty-five tons, along the canal; they do not insist that *all* the hands are wanted, while passing along the canal, but they do most strenuously insist that *all* the hands are wanted while *passing through the locks, owing to the disproportion between one and the other:* they argue, that it takes the full exertion of two men, to steady the boat, while in the lock, in consequence of the great agitation of the water, and that it would otherwise be materially injured. Now to remedy this inconvenience, I would propose the method used on the late Duke of Bridgewater's canal, from Worsley to Manchester; and likewise upon the Manchester, Bolton, and Bury canal; where the locks are much about the size of those upon the Schuylkill navigation, as shown in the following sketch,* in which the boats are represented passing along the canal, chained together, shoulder to shoulder, one man steering them both; and, likewise, passing the locks, two at once, by which means the lock is so nearly filled, that little room is left for moving about; of course the steersman, or captain, can easily manage them. The gangways, for the captain to step along with his boat hook, and the stages for the horse, while crossing at the dâms, are only temporary, and can be removed while loading and unloading. If the lock-keeper happen to be absent, the boy who drives, dismounts, unhitches his horse, assists in shutting, or opening, the gates, letting water into the lock, &c. These boats will carry upwards of twenty tons each, with thirty inches water in the canal, as the following calculation shows. Length of keel 64 feet; deduct 8 feet for cabin ends, leaves 56 feet length; breadth upon the beam, 7 feet 6 inches; allow each boat to draw 4 inches water, (which is double what she will draw,) then 2 feet 2 inches will be left for loading: $56 \times 7\frac{1}{2} \times 2\frac{1}{6}$ gives 910 cubic feet, the content of water displaced by the loading; now one cubic foot of water weighs about $62\frac{1}{2}$ pounds, but call it 60 pounds; then 2 feet will weigh one hundred, *long weight;* of course, 40 feet of water will be a ton; divide 910 by 40, the quotient will be $22\frac{3}{4}$ tons; which proves the above statement to be correct; of course, one man, one boy, and one horse, with two boats, will bring down about 45 tons, long weight, (or 2400 pounds to the ton,) which will save more than half a dollar per ton, on the present system; or rather, it would reduce the price of coal in the city of Philadelphia, and in other cities, as New York, Boston, &c. above 50 cents per ton. If the Schuylkill Canal Company should lower their toll, 50 cents per ton, which they (the acting committee) might well afford to do, considering that 45 tons will be brought down the canal, with less water than 25 can be brought down at present, coal would then be sold at 6 dollars, in the market, with the same profit it now affords, at 7 dollars. The insurance offices might well afford to insure houses, burning stone coal, for one-half the sum they insure for, when burning wood; and this would conduce much to increase the demand for it; and, likewise, to quiet the minds of the sick, and the timid, who are now so frequently disturbed by the rattling of engines, and the hoarse voices of the firemen. The boats above recommended, have flat bottoms, and upright sides, they will cost about 150 dollars each, are rather slower in speed, but much more profitable than the boats now in use: they would answer equally well upon the Union Canal, by bringing them two together along that navigation, and passing them singly through the locks, unto Reading, and then passing them along the Schuylkill navigation, as shown in the sketch; it would require from ten to twelve days, to complete a trip with them, from Philadelphia to Mount Carbon. On Canals in Lancashire, England, they have been used for more than twenty years, and found to answer for coal, and rock, in a more profitable manner than any other boats that have yet been devised. They are submitted to your consideration, and to that of the public, by a well wisher to your useful journal, to navigations, and to the coal trade, by

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* The drawing referred to, was among those which were lost. It has not yet been recovered, nor has Mr. Stott been in the city, or a new one would have been obtained. The Editor was unwilling further to delay the publication of the paper, as its general merits can be understood without the drawing; but this shall be hereafter supplied.

Yours, very respectfully,

JAMES STOTT.

Manayunk, April 21, 1827.

Remarks on a communication on the subject of Mill-Spindles, and Brands, published in a former number of the Franklin Journal.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—But for want of leisure, I should sooner have noticed some remarks contained in the Journal, for February last, upon "an improved mill-spindle," which had been described in your number for December, 1826.

From the long experience of William Poole, his testimony in favour of *cast* spindles is of some importance in reference to the fact, that in some parts of our country, though introduced years ago, they are not in general use; wrought spindles being usually preferred, because less liable to fracture, and more easily repaired. To obviate the first objection, cast spindles are commonly made heavier than those of wrought iron, and although the steel toe, and cockhead, have been used to prolong the wear, yet I have known the collars to be worn out in five or six years, (probably because all millers are not so careful as Brandywine millers) and then the spindle became useless, unless by the adoption of one part of my improvement—that of fitting on a separate collar.

The distribution of the metal in the hollow spindle, so as to obtain the greatest strength and stiffness for the weight, I maintain to be of some importance, as well in regard to economy, as to superior performance; objections thereto might be expected from the founder, rather than from the miller; and admitting all that is advanced by William Poole, on the absolute good qualities of a simple, solid, cast iron spindle, I cannot consider his inference correct, that there is little occasion, or room for improvement.

Suppose a water wheel gudgeon with *a neck smoothly turned*, and running on a *composition* ink, should be recommended as most durable, and working with the least friction; many a country miller, and mill-wright, might, and probably would, object and say, "there is no occasion for so much nicety; the improvement if any is 'unnecessary and of small value.' We have long used iron gudgeons with necks rough as cast, and running on inks of the same material; they last a long time, and when worn out, we have only to replace them with others." All this, so far as relates to their experience, would be true, but would form no argument against the superiority of the finished machinery, in the view of those who know its excellence, and it would remain without controversy, that it was not only best, but though doubly expensive at first, the most economical. If I have described a spindle, of materials the most durable, operating with little friction, of the greatest strength and stiffness for its weight, and admitting of repair with facility; do I assume too much in calling it a valuable improvement?

William Poole has obliged us with a description of a cast-iron brand for flour, which may be interesting to those to whom it is a novelty. Such brands have been long used in this neighbourhood, though of late years thrown aside in many of our mills, and cast-iron *stamps* substituted. They are preferred as more convenient and durable, and making a neater *print* on the barrel: they are commonly placed on a block, under the flour-press, with the letters up, like a printer's form; they are then primed, in a similar manner, with printers' ink, and the piece of heading to be marked, is laid, and pressed upon it. I should not have supposed this plan unknown at Brandywine, but for the remarks on brands by William Poole, and I verily believe he will on a fair experiment, allow it to be an improvement, though perhaps of small value.

BELIDOR.

Richmond, Va. June, 1827.

Correction of an error in calculating the mean pressure of elastic steam, in Mr. Perkins' paper on that subject.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR—In the interesting article published by Mr. Perkins, in the last number of your Journal, "on the economy of using highly elastic steam, expansively," I observe a small error in obtaining the mean pressure of the steam on the piston, in the 2nd, 3d and 4th quarters of the stroke. Mr. Perkins supposes, that the mean pressure in the 2nd, 3d and 4th quarters is equal to half the sum of the pressures at the extreme points; but this is not the case, and the error, although not of great practical importance, is an error in science. If we suppose each quarter to be divided into forty equal parts, then the following table will show the pressures, at the respective points of division.

2nd quarter.		*3d quarter.*		*4th quarter.*	
41	390.24	81	197.53	121	132.23
42	380.95		195.12		131.15
43	372.19		192.77		130.09
44	363.63		190.48		129.03
45	355.55		188.24		128.00
46	347.82		186.05		126.97
47	340.42		183.91		125.97
48	333.33		181.81		125.00
49	326.52		178.65		124.03
50	320.00	90	177.77	130	123.07
51	313.72		175.83		122.14
52	307.69		173.91		121.21
53	301.91		172.04		120.30
54	296.29		170.22		119.40
55	290.90		168.42		118.52
56	285.71		166.66		117.64
57	280.70		164.95		116.78
58	275.86		163.26		115.93
59	271.19		161.61		115.10
60	266.66	100	160.00	140	114.28
61	262.29		158.41		113.47
62	258.06		156.86		112.67
63	253.95		155.34		111.88
64	250.00		153.48		111.11
65	246.15		152.38		110.34
66	242.44		150.94		109.66
67	238.80		149.44		108.89
68	235.29		148.14		108.09
69	231.88		146.79		107.38
70	228.55	110	145.42	150	106.66
71	225.37		144.14		105.96
72	222.22		142.85		105.26
73	219.18		141.58		104.58
74	216.21		140.35		103.89
75	213.33		135.13		103.22
76	210.52		137.93		102.57
77	207.77		136.75		101.90
78	205.13		135.59		101.30
79	202.52		134.45		100.63
80	200.00	120	133.33	160	100.00
Mean,	274.76		161.81		117.07

From this table it will be seen, that the mean pressure in the 2nd quarter is 274.76 lbs.; in the 3d quarter 161.81 lbs.; and in the 4th quarter 117.07 lbs.; and likewise that the mean pressure for the three quarters is 184.54 lbs.

The method of obtaining these results will occur to the reader. For the first number in the table we have the proportion

41 : 40 : : 400 : 390.24; for the second 42 : 40 : : 400 : 380.95, &c.; or, since the second and third terms are always the same, we may find the numbers, by dividing the product 16000, by 41, 42, 43, &c. respectively, up to 160.

If we desire to know the power of the engine, (for a single stroke,) we have only to add together the numbers 400, 274.76, 161.81, and 117.07, which make 953.64. By comparing this number with the 1000, obtained by Mr. Perkins, it will be seen that his estimate of the power of the engine, is about 5 per cent. too high.

Respecting the utility of Mr. Perkins' engine, it must be left to the usual ordeal of experiment. His discoveries are brilliant, some of them triumphant; and there can be no doubt that his perseverance, and mechanical ingenuity, will eventually lead him to success. Every one who is a friend to public good, and to the promotion of the arts, will sincerely wish him success; and great praise is due to those who have patronized his efforts.

Q.

Description of a new Compensation Pendulum, invented by R. Lee Fearn, M. D. with general observations upon the subject. By the EDITOR.

The gentleman above named, has presented us with a drawing of an improved compensation pendulum, which is as ingenious as it is simple, and which, it appears to us, will answer well in practice.

We are indebted to that eminent artist, George Graham, for the first application of the principle, which, under various modifications, has been since applied, to preserve unchanged, the centre of oscillation in a pendulum, and thus to insure the performance of all its vibrations, in the same length of time.

When the art of clock-making had attained a high degree of perfection, and the application of this instrument to astronomical observations, rendered the utmost accuracy desirable, it was soon perceived, that the varying length of the pendulum rod, in consequence of its expansion by heat, and contraction by cold, was a source of irregularity, which it was deemed difficult to overcome. Those substances which were found to be least alterable by changes of temperature, such for example as wood, and particularly deal, (pine) were employed, in the best clocks. As the different metals are affected by heat in different degrees, Graham conceived the idea that the greater expansion of one, might be applied to counteract the less expansion in another. After a series of trials, during a period of five or six years, he succeeded perfectly, by attaching to the pendulum rod, a vessel containing mercury, which liquid, when the rod was expanded by heat, rose, from the same cause, in the vessel which contained it, so as to compensate for the downward expansion of the rod. This improvement was completed in the year 1721. Five years afterwards, John Harrison, a carpenter, of Barton, in Lincolnshire, subsequently so celebrated for his improvements chronometers, invented, and applied to a clock of his own manufacture, the pendulum, which, from its form, is called the gridiron-pendulum. In this, the expansion of the iron rod, is corrected by the greater expansion of rods of brass, or of zinc, which tend to raise the bob, in the same degree in which the expansion of the main rod, tends to lower it; and it, of course, is retained in the same place. In this form, the compensation pendulum is, to the present day, most commonly made. The principle upon which these pendulums were constructed, has received various modifications in the hands of different artists: the rods of Harrison's, for example, instead of being arranged in the form of a gridiron, have been enclosed in a tube, and greater elegance and compactness, with a more easy mode of adjustment, have been attained: these, however, we believe, comprise the whole merit of the modern improvements.

Figure 1, plate 2, represents the mode of compensation, proposed by Dr. Fearn. A is the pendulum rod, suspended by a flexible spring, in the usual manner, from the cock B. C is a rod, or bar, of zinc, attached to the back plate of the clock, by a screw at its lower end. The head, D, of this bar, works upon a pin, which forms a joint, as represented in the drawing. Through this head, there is a mortice, which allows one end of the lever, E E, to pass through it, and within which, it may be fixed firmly, by means of a tightning screw. The lever E E, is attached to the clock plate by a screw, which is also its fulcrum. Through a slot, in the inner end of this lever, the suspending spring passes, and is closely embraced by it, on its lower side.

The operation of this apparatus, will readily be perceived; as the rod A lengthens by heat, or contracts by cold, the rod C, will be similarly affected. The expansion of C, will cause the inner end of the lever to descend, and, consequently, to embrace the suspending spring, at a lower point, and thus to diminish the effective length of the pendulum. The mode of adjustment is obvious, as a greater, or lesser motion may be given to the lever, the upper end of the rod C, being made to approach, or recede from its fulcrum. To obtain the requisite accuracy, an adjusting screw, may be made to act upon the head D.

We are aware that the clock plate will expand, when the rods of iron, and of zinc, undergo that change, but the superior expansion of the zinc, will still render the attainment of the compensation, perfectly easy.

The inventor has proposed some other modifications of the same principle, but as we deem the one represented, the best, we present it, alone, leaving the variations, and the details, to the judgment of the practical mechanic.

FRANKLIN INSTITUTE.

FOURTEENTH QUARTERLY REPORT.

At a special meeting of the Franklin Institute, held at their Hall on the 23d July, 1827, the following Report of the Board of Managers, was read, and accepted.

Philadelphia, July 19*th*, 1827.

The Board of Managers of the Franklin Institute, in obedience to the laws of the Institution, present to the general meeting their Fourteenth Quarterly Report.

Although the present, is not the season for the more public operations of the Institute, the Board have been occupied in devising such measures, as experience has proved to be requisite, to ensure the beneficial prosecution of the objects of its formation; the utility of which, they confidently hope will be fully manifested, at the approaching period for the delivery of the public Lectures, and the opening of the drawing school.

In the last Report of the Board, it was stated, that experience had shown, the necessity of regulating the attendance of minors, in the Lecture room; much inconvenience having resulted fromthe disorderly conduct of some of those who have been heretofore admitted. In conformity with these views, the Board have adopted the following regulations.

Tickets admitting youths to the Lectures shall not be issued, excepting their parents, guardians, or masters, will certify, that they are. at least, sixteen years of age.

Seats are to be designated for such youths, and should they refuse to occupy them, their tickets shall be forfeited.

They shall not be permitted to enter the room, after a Lecture has commenced.

The tickets of those youths, who are guilty of improper conduct, in, or near, the Lecture room, so as to disturb the Lecturer, or the company attending, shall be forfeited.

As there are many youths under the designated age, whose deportment would be perfectly decorous, and who would derive advantage from attending the Lectures, the Board have resolved, that where a parent, guardian, or master, will give an assurance that he will accompany, and keep by him, any youth who has not attained the age of sixteen, the Treasurer may issue a ticket to such person, with such a conspicuous mark thereon, as shall enable the doorkeeper, at once, to see its purport. But separate tickets, are not to be issued, for such youths.

It has also been determined, that the Hall of the Institute, shall not, hereafter, be let, or granted, for the use of meetings for political, or religious discussions. For, although the Hall, when let for public purposes, is out of the hands of the Institute, and it is not therefore, a party, in any such discussions, it has been found, that the mere permission thereof, has had an unfavourable influence, upon the public mind; and it has consequently been deemed proper to restrict the use of the Hall, to purposes purely literary, scientific, or beneficent.

Measures are in train, under the superintendence of the Library Committee, which it is believed will tend to the increase of the library, and to its active usefulness.

The High School of the Institute has continued in a flourishing condition. The first examination of the pupils has just commenced, and it is expected, will justify the anticipations of its patrons.

The Board have great pleasure in stating, that the Franklin Journal, published under the auspices of the Institute, has obtained a very extensive circulation; and that there is therefore no doubt whatever of its permanence.

The Institute has already been informed, that it was the intention of the Treasurer, John Richardson, who has so ably and faithfully performed the duties of that office, to retire. His last report is herewith presented. Mr. Samuel V. Merrick has consented to serve, in his place, during the remainder of the year.

The Report of the Treasurer, it will be seen, exhibits a deficit of $116 32. This has arisen from the change made in the time of the annual payment from members, which was formerly received on the 1st of January, but is now, payable on the 1st of October; this deficiency is, therefore, to be considered as a temporary result of that arrangement.

By order of the Board of Managers,
HENRY TROTH, *Chairman.*

THOMAS P. JONES, *Secretary.*

Report of the Committee of Inventions of the Franklin Institute, on a Wind-mill with vertical sails, invented by M. Biard, of Paris, and by him denominated the Anémotrope.

THE Committee of Inventions having carefully examined the model of the Anémotrope, together with a printed memoir on the subject, containing a description, and engravings of the sails and their appendages, which the inventor, M. Biard, of Paris, in the kingdom of France, has presented to the Institute, report:

That the novelty in the proposed windmill, consists in the manner in which the sails are disposed, and affixed to the shaft; and that in these particulars, it differs materially from the horizontal windmill most commonly used in this country. A vertical shaft, connected with the machinery to be operated upon, is made to extend above the mill-house, and is to be carried round by the action of the sails. There are four pair of sails, each pair being attached to a piece of timber which is to cross the vertical shaft, at right angles; there are, of course, four of these pieces of timber, each of sufficient length to receive two sails, and to allow the requisite distance, between their inner extremities; by which intermediate part, these timbers with their sails, are to be hinged to the vertical shaft.

The pairs of sails, are so nailed, or screwed, to the extremities of the timbers, which form their arms, that their planes cross each other at right angles. Upon the vertical shaft, at a distance from each other, about equal to the width of the sails, there are four short transverse pieces of square scantling, firmly attached, for the purpose of sustaining the timbers which form the arms of the sails, and which are to be hinged to them. A bird's eye view, of the vertical shaft, would present the projecting ends of these short pieces, as forming with each other, an angle of 45 degrees. The timbers or arms, are so hinged to the transverse pieces, that the sails which they carry, will, when not acted upon by the wind, each form an angle of 45 degrees with the horizon; but when receiving the full force of the wind, they will turn so as to expose one sail to its action, whilst the other, standing in the plane of the horizon, will not feel its influence. From this arrangement of the sails, it results, that whatever may be the course of the wind, the shaft will still be turned in the same direction, and the sails will always be acted upon, with a force proportioned to its intensity.

In all mechanical inventions, the test of experiment, and that upon a scale which shall exhibit the actual operation of the machine, is necessary, before we attempt to pass a final judgment in its favour. In the present case, the model operates perfectly well, and is affected by a very light breeze. The simplicity of the structure, can scarcely be surpassed, which in mechanical contrivances, where utility is not sacrificed, is no small praise; and this does not appear to be the case in the present instance.

There is not any provision made for contracting the sails, in case of increased intensity in the wind; this, however, may be accomplished, with the same facility as in the ordinary wind-mill.

In its mode of operation, this bears a considerable resemblance to some other horizontal mills, but particularly to that of Beatson, which was patented, in England, in the year 1797; the arrangement of the sails in M. Biard's, however, appears preferable to Beatson's; but still, it is a fact, that, the horizontal mill, in any of the forms hitherto tried, is inferior in its action to the vertical, although it may, under certain circumstances be preferred to it. In estimating the merits of any horizontal mill, it ought, therefore, to be compared with other horizontal mills, and not with the best upon the old construction.

The Committee have annexed a drawing of M. Biard's mill, with references to explain its action.

Philadelphia, April 4th, 1827.

Attest, THOMAS P. JONES, *Secretary.*

Figs. 4 and 5, plate 2, are drawings of M. Biard's mill.

A, A, Fig. 4. the upright shaft.

a, *b*, *c*, *d*, *e*, *f*, *g*, *h*, the sails upon their respective arms.

d, is in full action, whilst its fellow, *h*, is turned edgewise to th wind.

c, has passed beyond the point of full action, and

b, and *f*, present their ends to the wind, whilst
a, is just coming into action.

i, Fig. 5, is a section of one of the transverse pieces upon the shaft, and *k*, of one of the arms to which the sails are attached: this latter is hinged by one of its angles to *i*, which admits of its turning so as to bring the sails, represented by the dotted lines, alternately, into a horizontal, and vertical position.

l, is a rod and ball of metal intended to balance the sails, so that when out of action, they may rest in the position represented by the dotted lines. This balance may be seen on the arms in fig. 4, and its use is evident, on inspecting fig. 5, the hinge being on one side of the piece carrying the sails.

Remarks upon the properties essential in good gunpowder, and upon the methods of testing its strength. By Joshua Shaw, Esq.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—Being a constant reader of your Journal, and always interested in new discoveries and improvements, my attention was arrested by an article in your last number, on the strength of American gunpowder. The subject is one of which I may claim some knowledge, from a practice of more than thirty years, in the sports of the field; and from having myself performed numerous experiments in relation to it, and paid much attention to the experiments and opinions of others.

Although I differ, in some points, with captain Baird, and with the writer of the "Manual," we all agree, that powder to be good, should be quick, strong, free from impurity, and not liable to attract moisture from the atmosphere. In the article alluded to, it is said, that "several methods for proving, or trying, the strength of powder, have been adopted, but with the exception, perhaps, of Mr. Dupont's eprovette, none of them can be relied on for much accuracy." Now, in my opinion, this eprovette is equally defective with those usually employed, and which I consider as worse than useless. Their great fault is, that a similar result may be obtained by them from powder which is strong, and from such as is comparatively weak, but which excels the former in quickness.

The real strength of powder depends upon the quantity of gas resulting from its explosion: the coarser kinds frequently yield more than the finer; every experienced sportsman knows, that with coarse powder, he can kill wild-fowl at a greater distance than he can with the best cannister, although the measure of both be the same, yet, in this case, the weight of the fine will exceed that of the coarse. The blow upon the shoulder, it is true, will be most powerful from the fine, that from the coarse being scarcely felt; the cause of this is, the coarse burns with comparative slowness, and giving out a large volume of gas, the elastic force increases, until the shot leaves the muzzle of the gun; whilst that which is fine, being generally quicker, has every grain ignited at nearly the same moment, and exerts a sudden force, which is felt like the blow of a hammer; but this force does not continue, but relaxing before the shot is discharged, these latter are retarded by friction, and pass on with decreased velocity. A little reflection will make it apparent, that the quickest, and not always the strongest, powder will tell best, either in the eprovette described, or those referred to in the article in question. It is true, that the quickest powder may also be the strongest, but the test given is fallacious, and is calculated to lead into error; besides which, were the means good, but few persons could avail themselves of them, as they have no instrument at their command. I will therefore describe the mode which I have followed, and which can be practised by every man who has a gun; but I will first add a few words upon the properties of powder.

In field sports, the percussion gun has effected a considerable revolution; having caused such powder to be preferred, as was formerly rejected. Strength, not quickness, is now the important point, because the fulminating powder used for priming these guns, distributes the fire with the quickness of lightning, throughout the whole charge, and at once ignites every grain, thus rendering what, in the old gun, was slow powder, many times more rapid in its combustion, than the quickest powder formerly was. A quick powder is rendered so much more so, when ignited in this way, as to resemble, in its action, some of the fulminating powders, and consequently to endanger the bursting of the gun. The English manufacturers are evidently aware of this effect, as is evident in a number of fine guns lately imported by Mr. Constable, of this city: they are thickened near the breech, whilst they are kept as light as usual, by lessening their thickness in other parts where the metal might safely be spared.

The effect of a too rapid explosion may be illustrated by the action of the fulminating powders, of which there are several kinds. A small charge of these will burst the strongest fowling piece, but will not throw a ball ten paces. Although strength is always an important point, I think that it must now be manifest, that it is dangerous to confound this property, and quickness, with each other.

Impure or dirty powder is the detestation of every sportsman, as it is a fault without remedy. If his powder be weak, he may add to his charge, and obviate this evil. I have freely used the Brandywine powder, and also Pegou's, and have consulted with many of my friends, who have also used both; all have agreed that the Brandywine is both strongest and quickest; but all have also agreed that it is much less cleanly, soiling the gun more than Pegou's, and giving to water, in which the barrel is washed, an ink-like appearance, whilst a grayish tint only is produced by the latter, without much injuring the transparency of the fluid.

Had captain Baird tested the powder intended for ordonance, he would have probably found that the English manufactured article is not yet equalled by that made in this country. This, at all events, was the case with a quantity found on board the Lady Johnson, captured during the last war, on her voyage to Canada. The fact rests on the testimony of every one who had an opportunity of trying it. This is a point of great importance, and well worthy the attention of the government, and of the manufacturers of the article.

I will now describe the mode which I have adopted in testing the *strength* of gunpowder. The machinery which I employ, may not be very scientific, but it is, nevertheless, certain, and uniform, in its results. I place a piece of board, vertically, with a hole in it, of from six to eight inches in diameter, over which I nail a quire of paper, by the two upper corners; the sheets are compact, as taken from the ream: writing paper is to be preferred. This is my target, at which I fire from a distance of thirty or thirty-five yards. My shot is weighed, and the powder measured, with some care; and before firing at the target, I turn up six or eight leaves of paper, placing over them a loose board, to protect them from the shot. I then fire, say No. 6 shot, and if the powder be strong, many of the pellets will pass entirely through the paper: if more than half pass through, I turn down some of the sheets, and thus proceed until it is perforated by about one-half of the number discharged. Other kinds of powder may now be compared with that first used; one, may not cause a single pellet to pass through, whilst from another, the whole charge will pass; by increasing or decreasing the number of sheets, you may find a difference of twenty per cent, and that, in favour, sometimes, of powder which appeared the weakest by the common eprovette. The correspondence between this mode and the practical use of powder, is apparent; and experience has proved it to be the best.

The trial, by firing powder on white paper, is altogether fallacious; some kinds not soiling it, which yet are absolutely filthy, when used in the gun; and some burning quickly in the loose heap, which are slow when rammed down.

I trust I have proved, that quickness is a property in powder, much less durable than formerly; and that elastic force, and purity, are the main requisites.

Should you sir, however, wish for further evidence upon this point, it will afford me pleasure to furnish you with my mode of testing the quickness of powder, which measures the time required to burn different kinds of powder with such accuracy, that in numerous trials the difference in the results will be a mere fraction.

In offering these views, I have not been prompted by any invidious motive; my aim has been to ascertain the truth; in two out of three of the main points, I have confirmed the statements of captain Baird, although in some minor particulars we have not agreed. I am not an adept at writing, but having had much practice, in the use of gunpowder, I have attempted to describe what I have actually observed; and if I have succeeded in making known any thing which may have escaped the notice of others, my observations will possess some value.

Very respectfully yours,

JOSHUA SHAW.

Philadelphia, July 18th, 1827.

ON JAPANNING AND VARNISHING.—No. 6.

FROM CORRESPONDENTS.

We resume this subject, after a long interval, and present two communications, appertaining to this department; one of which we some time since promised to our readers; and both of them will be found to be valuable. We expect some other processes, and recipes, which have been long promised, by a gentleman able to give us much aid.

It has been a great desideratum among artists, to render shellac colourless, as, with the exception of its dark brown hue, it possesses all the properties essential to a good spirit varnish, in a higher degree than either of the other resins. A premium of a gold medal, or thirty guineas, "For a varnish made from shell, or seed lac, equally hard, and as fit for use in the arts, as that at present prepared from the above substances, but deprived of its colouring matter," has long been, and is still offered, by the Society, in London, for the encouragement of Arts, Manufactures, and Commerce. These ends are perfectly attained, by the process given by Dr. Hare, which leaves nothing to desire, excepting on the score of economy. Were the oxymuriate of potash, to be manufactured in the large way, the two processes, that of making the salt, and of bleaching the resin, might be very advantageously combined.

Method of bleaching shell, or seed lac. By R. Hare, M. D.

Dissolve, in an iron kettle, one part of pearlash, in about eight parts of water, add one part of shell, or seed, lac, and heat the whole to ebullition. When the lac is dissolved, cool the solution, and impregnate it with chlorine, till the lac is all precipitated.

The precipitate is white, but its colour deepens by washing and consolidation; dissolved in alcohol, lac, bleached by the process above-mentioned, yields a varnish, which is as free from colour, as any copal varnish. R. H.

Chlorine, or oxymuriatic acid, may be formed, by mixing, intimately, eight parts of common salt, and three of the black oxide of manganese, in powder. This mixture is to be put into a retort; four parts of sulphuric acid, diluted with an equal weight of water, and afterwards allowed to cool, is to be poured upon the salt and manganese, when the gas will immediately be liberated, and the operation must be quickened, by a moderate heat. If the mixture be made, without the sulphuric acid, and this be added, in small portions, the heat generated by this means, will be sufficient to disengage the gas, without the aid of a lamp. A tube leading from the mouth of the retort, must be passed into the resinous solution, when the gas will be absorbed, and the lac precipitated.

On the preparation and use, of a Mastic Varnish, particularly suitable for Paintings in Oil. By Joshua Shaw, Esq.

TO THE EDITOR.

Sir—Amateurs, and collectors of paintings, are frequently at a loss for a varnish properly prepared, and suited, for the purpose of restoring and preserving the colours, in works of art. I submit the following observations on the preparation of a very good one, and the best mode of applying it to the surface of pictures painted in oil.

Experience has shown, that for this purpose, mastic varnish is in general, preferable to any other, especially in the hands of inexperienced persons, and, with but few exceptions, even in those of the adept. This varnish is generally prepared, by dissolving the mastic in spirits of turpentine, over a sand heat, in a well glazed earthen, or in a copper vessel, occasionally shaking, or stirring it about, until entirely dissolved, which will take place before it arrives at a boiling heat; after which, it is strained through a piece of calico, in preference to linen, as it is less apt to give off lint, which is very troublesome when it gets into the varnish: it is then put into a bottle, well corked, and placed for two or three weeks where the light of the sun can strike it, which will cause a large precipitation of mucilaginous matter, and render it as transparent as water. It is now to be decanted off into a clean bottle, and put by for use. This is the mode of preparing that commonly sold in the shops; but to insure a varnish that can be depended upon, the following observations must be attended to. Let all the mastic be bruised by a muller on a painter's grinding stone, which will immediately detect the soft, or oily tears, which must be rejected; as when dissolved in the mass, they prevent the varnish from drying hard, leaving a greasy, or tacky surface. The next point of importance, is to procure, if possible, turpentine which has been distilled a second time; but, where this is not to be had, the best kind sold in the shops must be taken; but it must be perfectly clear and colourless, otherwise, good varnish cannot be obtained; it must not be furnished through an oily measure, (which is but too commonly the practice) but poured out of the carboy without shaking or disturbing it. If any doubts are entertained as to its purity, put about two table spoonfuls into a common white saucer, and let it evaporate in the sun, which will be effected in two or three hours; and if it leave a greasy residuum, or a soft sticky mucus, it must be rejected; that only is good, which entirely disappears. Thus prepared with good spirits of turpentine, and with mastic bruised and picked, the two ingredients may be put into a clean bottle, when the resin may be dissolved without heat, by half an hour's shaking in the hand; it must then be strained, and afterwards treated as before recommended.

The French sometimes prepare this gum in spirits of wine, (pure alcohol) but it is subject to chill on the picture, and produces, in time, a kind of white scale over it, which injures its lustre.

When it is prepared after the manner recommended, six ounces of pounded gum, are mixed with fourteen ounces of pure spirit of turpentine, which may, if found too thick, be diluted with more turpentine. It should be laid on with a soft, flat, camel's hair brush, as it is called, but which however, is made of the hair obtained from the squirrel's tail. The varnish should always be laid on with as much despatch as possible, keeping it alive, as the artists term it, and floating after the brush. It may be proper to observe, that no kind of varnish should be applied to any painting, without first cleaning it; nor to a newly painted picture until it is perfectly hard, to effect which, requires five or six months. Before varnishing, be careful to remove all grease from the surface, by a coat of whiting, (not lime) dissolved in water, and laid on so that it covers, and entirely obscures the picture; this should be allowed to dry, and to remain on for one or two hours, when it must be entirely removed by a sponge and some clean rain water; then perform the operation of varnishing in a still room, free from lint and dust.

It will sometimes happen, that a picture, where the surface is smooth, will look too bright and glaring, which is both disagreeable to the eye, and injurious to the effect of the picture: to remedy this defect, after the varnish is quite dry, say in ten or fifteen days, sponge the picture all over with pure rain water, for about one or two minutes; and having squeezed the sponge, and made the picture as dry as the sponge will leave it, pass, lightly, a clean silk handkerchief over it, with great rapidity, until it become perfectly dry; when a clear, steady, lucid, appearance, will pervade the whole picture. Breathing occasionally on the picture to damp it, will assist the operation, while chafing it with the handkerchief.

Yours, very respectfully,
JOSHUA SHAW.

Philadelphia, July 12th, 1827.

On the Saccharum of the sweet potato, (convolvulus battatas) as a substitute for malt, in the preparation of beer, and for other purposes. By ROBERT HARE, M. D. *Professor of Chemistry in the University of Pennsylvania.*[*]

Dr. Tidyman, of South Carolina, lately supplied me with some sweet potatos, of a kind in which the sweet matter is peculiarly abundant, and requested that I would ascertain if there were any sugar in them. Having pared, and, by means of the instrument used for slicing cabbages or cucumbers, reduced them to very thin slices, about a pound was boiled in alcohol of the specific gravity of .845, which appeared to extract all the sweetness, yet on cooling yielded no crystals of sugar. The solution being subjected to distillation, till the alcohol was removed, an uncrystallizable sirop remained. In like manner, when aqueous infusions of the potatos were concentrated, by boiling or evaporation, the residual sirop was uncrystallizable. It appears, therefore, that the sweet matter of this vegetable is analogous to molasses, or to the saccharum of malt.

Its resemblance to the latter was so remarkable, that I was led to boil a wort, made from the potatos, of proper spissitude, say s. g. 1060, with a due quantity of hops, for about two hours.

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[*] Communicated, originally, to the Agricultural Society of the State of Pennsylvania.

It was then cooled to about 65 degrees, and yest was added. As far as I could judge, the phenomena of the fermentation, and the resulting liquor, were precisely the same as if malt had been used. The wort was kept in a warm place until the temperature 85 F. and the fall of the head, showed the attenuation to be sufficient.* Yest subsequently rose, which was removed by a spoon. By refrigeration a further quantity of yest precipitated, from which the liquor being decanted, became tolerably fine, for new beer, and in flavour, exactly like ale made from malt.

I have computed that five bushels of potatos, would produce as much wort as three bushels of malt; but I suppose that the residue would, as food for cattle, be worth half as much as the potatos employed.

I believe it possible to make as good liquor from malt in this country, as in England, but that in our climate much more vigilance is required to have it invariably good; principally, because the great and sudden changes of temperature, render malting much more precarious. Should the saccharum of the sweet potato, prove to be a competent substitute for that of germinated grain, the quality will probably be less variable, since its development requires but little skill and vigilance. Besides, as it exists naturally in the plant, it may be had where it would be almost impossible to make, or procure malt. Hops, the other material for beer, require only picking and drying to perfect them for use. They are indigenous in the United States, and may no doubt be raised in any part of our territory.

I have dried, in my evaporating oven, some of the sweet potatos in slices. It seems to me, that in this state, they will keep a long while, and may be useful in making leaven for bread. They may take the place of the malt necessary, in a certain proportion, to render distiller's wash fermentable. The yest yielded by the potato beer, appeared in odour and flavour, to resemble that from malt beer surprisingly, and the quantity, in proportion, was as great. In raising bread it was found equally efficacious.

I propose the word *suavin*, from the Latin suavis, sweet, to distinguish the sirop of the sweet potato. The same word might, perhaps, be advantageously applied as a generic appellation to molasses, and the uncrystallizable sugar of grapes, of honey, and of malt.

Crystallizable sugar might be termed *saccharin*, since the terminating syllable of saccharum, is appropriated, in chemistry, to metals.

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* In passing to this state, there should be a loss in gravity of about 4 per cent.

Some account of the Hot Springs, in Bath county, Virginia, in a letter to the Editor, from P. A. Browne, Esq.

Hot Springs, Bath county, Va. 1st July, 1827.

Dear Sir,

If you have been surprised to learn, from my former letters, the variety of waters at "Warm Spring," you will be much more so with their enumeration at this place, all of them lying within the circuit of a few hundred feet. There is a fine spring of very cold water, which does not appear to partake of any mineral qualities. There is another not quite so low in temperature, but which, being more copious, is conveyed to the house, through logs, and used for drinking and culinary purposes. From underneath a small ledge of rock, proceed two springs, one very cold, and the other moderately warm; these mingle their waters together. Just above their point of junction, you may, at the same time, immerse one hand in *warm*, and the other in *cold* water. There is a spring of warm water, which I am assured, (except in point of temperature,) resembles the celebrated water of the "Sweet Springs." There is a small spring of limestone water. There is a very copious spring of water, at the temperature of 96, which is covered with a house, and termed the "Moderate Bath." Another, called "the *Spout*," at the heat of 103°; and lastly, "the Boiler," which flows at the high temperature of 107°. The Spout, is so called, from the circumstance of the water being, in part, conveyed through a log, from the end of which, rheumatic, and other patients, allow it to fall upon the part affected.

The scenery here is grand, and the views from the summits of the surrounding hills, commanding. I have scarcely ever seen a place for which nature had done so much, and man had done so little. The land was taken up in two tracts, which are divided by a creek; each owner possessing an equal right to the springs. One parcel is owned by the widow, and two grand children of the gentleman who formerly kept the boarding house; they lease it to the present occupant, from year to year; the tenant, of course, feels no great inducement to improve it. The house is very much out of repair, and the whole establishment bears the appearance of being neglected. The other tract is owned by a gentleman who is far advanced in years, and who, being opulent, will not, in all probability, improve it. It is to be regretted, that the whole could not fall into the hands of some gentleman of fortune and taste, who would embellish it; with the expenditure of a few thousand dollars, it might be made not only the most beautiful, but also the most useful watering place in Virginia; possessing, as it does, the superior advantage of variety, in the waters. The cures that have been effected, by the use of the *Boiler*, are almost incredible. It is no uncommon occurrence to see persons, afflicted with rheumatic complaints, come hither on crutches, and to find them, in two or three weeks, entirely restored. There have been instances of persons brought on a litter, and riding home on horseback. There is a gentleman, now here, who had nearly lost the use of his right arm; the veins had sunk into the flesh, so as scarcely to be visible; the limb had diminished in size, and was as cold as death. When he arrived at the Hot Springs, he had not had regular sleep for upwards of three months; night after night he had paced his chamber in agony, not pretending to take off his clothes, and catching only a few moments repose, while lying on his stomach, across the foot of the bed. The night after he had taken the first bath in the Boiler, he slept soundly, from ten o'clock till breakfast time. His arm has resumed its temperature; the veins are filled, and the pain has so much diminished, that I make no doubt, but in a month's time, he will be entirely well.

The heat of the water is probably occasioned by the decomposition of the sulphurate of iron, with which this valley abounds, and immense quantities of which, no doubt, exist in the mountain. Streams of water passing through these beds of pyrites, produce decomposition, caloric is disengaged, and the water is, at the same time, saturated with sulphuretted hydrogen gas. About five miles below this place, upon the farm of Mr. Stonestreet, is a spring, similar, in some respects, to those at this place, on the banks of which you may procure sulphate of iron, in large quantities. The water of the Hot Spring contains, also, a portion of lime, which it deposites, in minute concretions, wherever it has an opportunity of evaporating, and is to be found in the form of a calcareous tufa, along the banks of the creek. The stream supplied from the various springs, is, at the distance of less than half a mile from their sources, capable of turning a mill. On the western side of the town is a mountain which, by way of distinction, is called "the Little Mountain," though its height is very little inferior to the Warm Spring mountain. Its rise is upon an angle of about 45°; its assent is difficult, on account of the immense number of loose stones with which the ground is completely covered. I was induced to ascend to the very top, and although it was a warm and toilsome task, I did not regret it. I collected some very fine specimens of ferruginous sand stones, with animal and vegetable impressions; and I had an opportunity of viewing a complete wall of sand stone rocks, as regularly piled, one upon another, as if done by a mason, and which extended the whole distance of my journey.

Yours truly,

P. A. Browne.

Dr. T. P. Jones.

ESSAYS ON LITHOGRAPHY.—No. II.

Ink for Writing, or Drawing, on stone, or on Autographic Paper.

The principal operation in lithography, consists in impregnating a stone with fatty substances, very superficially, so that, in consequence of the affinity which exists between these substances, and their power to repel water, the points, or lines formed with them on stone, shall be capable of retaining other such substances whenever they are brought in contact with them; while these same substances, will be repelled by the moisture which the stone has imbibed in those parts which they do not cover. Thus, when lines have been made on a stone, with lithographic ink, or crayons, into the composition of which fatty bodies enter, and afterwards a roller charged with a fat or oily ink, be passed over these stones, this ink will be deposited on the traces of the crayon, or of the lithographic ink, in a thin layer, but sufficient to produce an impression; whilst it will not adhere to any parts of the stone, which are not impregnated with the fatty matter, and which, besides, are kept in a moist state. It is on this point, that all the art of lithography depends; and it is only requisite, therefore, to discover what substances, by a proper combination, can be made most suitable to answer the double purpose of producing a good drawing, and of receiving the ink, which is to form the impression. It will be apparent, that it is not a matter of indifference what kind of fatty substance be used, with which to form a drawing, or to trace a writing, on the stone. These substances, in their natural state, if brought into contact with a stone, would diffuse themselves in every direction, and, consequently, would not be capable of forming points, or lines, sufficiently fine, and well-defined, to give to a drawing, the delicacy, precision and harmony, which it ought to have. It is necessary, then, to find a liquid composition, by which may be traced, lines as clear and well-defined, as those made on paper with Indian ink, and also a solid preparation, which will produce the same results as the common crayons, used by artists. Hitherto, it has only been possible to effect this, by forming a kind of soap, by the combination of fatty or resinous substances, with an alkali. This soap, when liquid, does not spread, as do grease and oils; and when in a solid state, it has such a degree of consistency as to enable the artist to produce on stone, all the effects of a drawing. But as soapy bodies are, in general, soluble in water, and as the water with which it is necessary to moisten the stone, and consequently the drawing, before applying the printing ink, would destroy the drawing, by dissolving the soapy substance with which it was formed, it was necessary to find a means of reducing this soap to the state of a fatty body, insoluble in water. This is effected by spreading over the stone, and over the drawing, an acid, which, by uniting with the alkali of the soap, reduces the latter to the state of grease. This operation, of which we shall say more hereafter, is called *the preparation.*

Lithographic ink, if good, will be soluble in distilled water, and in all spring, or river water, which is capable of perfectly dissolving common soap. It ought to flow freely from the pen, and not spread on the stone; it must also be capable of forming extremely fine lines, and should be very black, in order to render the work of the artist perfectly clear, and distinct. The most essential quality, however, is that of imbedding itself firmly in the stone, so as to reproduce the most delicate touches of the drawing, and to afford a great number of impressions; in order to this, it is necessary that it should be capable of resisting the acid which is spread over it in the *preparation* so as not to have its fatty particles either removed, or altered.

A host of recipes for making lithographic ink and crayons, have been published, and scattered, both in Germany, and in France. M. Senefelder, in his work, gives eight receipts for making this drawing ink; yet, assuredly, he has not published that which he considers the best. We think it superfluous to give these receipts, as it would only serve to create uncertainty in choosing from among them, and especially as we consider them all, more or less, inferior to that which we have used for a long time, and with uniform success. It was after having tried a great number of compositions, that we gave the preference to the following.

Lithographic Ink.

Soap, from suet, or tallow,—dry,	30	drachms.
Mastic in tears,	30	do.
Soda, of commerce,	30	do.
Shellac, in plates,	150	do.
Fine lamp black,	12	do.

Soap made of tallow, is to be preferred to that prepared from oil. But as soap is more or less hard according to its age, and the dryness of the situation in which it has been kept, it must not be used in exactly the above proportions with the other articles, without regard to its being either moist, or dry. To obviate this source of error, and to obtain the exact proportions, the soap should be cut with a knife, into thin slices, and exposed to the sun and air, until it is perfectly dry; it is then to be put into a box lined with paper, and thus kept, in a very dry place, until it is wanted for use. The best lamp black, which is the product of the combustion of rosin, should be used.

In order to melt these materials, a copper, or cast metal skillet should be used, which should be furnished with a wooden handle; it will also be found convenient for it to have a lip on its edge, in order that the material may pass more readily into the moulds; particularly when crayons are to be made. The soap is first put into this vessel, which is then to be placed over a brisk fire in a chafing-dish; when this is well melted, the shellac is to be thrown in, which will fuse very readily; the soda is then to be added a little at a time, and after this, the mastic, taking care to stir it with a spatula furnished with a wooden handle; lastly, the lamp black is gradually put in, stirring it between every successive addition, until the mixture is complete. A very brisk fire is used, that the materials may be perfectly fused. The shellac is apt to swell up; it is, therefore, put into the skillet gradually, that it may not boil over. When all these materials are well incorporated, they are poured out on a plate of cast iron, made very warm, and rubbed over with oil, in order that the composition may be easily detached from it. Before the mass is poured upon the plate, ledges are formed around it, with pieces of wood, which serve to prevent the mass from running off, and enables us to preserve it of an equal thickness throughout; when these pieces are removed, the composition is to be cut into strips, by means of a knife, which should be guided by a rule; this must be done whilst the material is warm. Little sticks are thus formed, similar to those of Indian ink: it would, however, be more convenient to have moulds, in which to pour the composition.

Many who have written on the subject of lithography, have recommended, not merely the melting, but the partial burning of the materials, with which lithographic ink and crayons are to be composed; but this is a bad method, since it is impossible, in this way, always to obtain the same combinations; as some portion of the materials would thus be wholly destroyed. The means of obtaining good ink, must depend on the nature of the materials, and upon their being duly proportioned to each other; and to accomplish these ends, it is not necessary to have recourse to combustion.

The ink of which we are about to give the composition, is used either with the pen, or the camel's hair pencil, for writings, dotted, and aquatinta drawings, those of a mixed character, or those intended as imitations of wood, or other engravings.

Autographic Ink.

We proceed to describe, practically, the process for preparing the autographic ink, or that kind, which is suitable for transferring on to the stone, the writings, or drawings, which have been executed on paper prepared for that purpose.

This ink ought to be mellow, and somewhat thicker than that used immediately on stone; so that when it is dry on the paper, it may still be sufficiently viscous to cause it to adhere to the stone by simple pressure. The following is the manner of preparing the ink:—

Dry soap,	100	drachms.
White wax, free from tallow,	100	do.
Mutton suet,	30	do.
Shellac,	50	do.
Mastic,	50	do.
Lamp black,	30 to 35	do.

These materials are to be melted in the way we have described for lithographic ink.

Autographic Paper.

The operation by which a writing or drawing is transferred from paper to stone, not only affords the means of abridging labour, but also of producing the writings, or drawings, in the same direction in which they have been traced; whereas when they are executed immediately on stone, they must be performed in a direction opposite to that which they are eventually to have. Thus it is necessary to draw those objects on the left, which, in the impression, are to be on the right hand. To acquire the art of reversing subjects, when writing or drawing, is both difficult and tedious; while, by the aid of transparent, and of autographic paper, impressions may be readily obtained, in the same direction as that in which the writing, or the drawing, has been made.

In order to make a transfer, on to stone, of a writing, a drawing in lithographic ink, or in crayons, or an impression from a copper-plate, it is necessary, 1st, that the drawing, or transcript, should be on a thin and flexible substance, such as common paper; 2d, that it should be capable of being easily detached from this substance, and transferred entirely on to the stone, by means of pressure. But as the ink with which a drawing is traced, penetrates the paper to a certain depth, and adheres to it with considerable tenacity, it would be difficult to detach them perfectly from each other, if, between the paper and the drawing, some substance was not interposed, which, by the portion of water which it is capable of imbibing, should so far lessen their adhesion to each other, that they may be completely separated, in every point. It is to effect this, that the paper is prepared, by covering it with a size, which may be written on with facility, and on which the finest lines may be traced, without blotting the paper. Various means may be found of communicating this property to paper. We will give a preparation which we have always found to succeed, and which, when the operation is performed with the necessary precautions, admits of the finest and most delicate lines being perfectly transferred, without leaving the faintest trace on the paper. For this purpose, it is necessary to take a strong, unsized paper, and to spread over it a size prepared of the following materials:

Starch, - - -	120	drachms.
Gum arabic, - - -	40	do.
Alum, - - -	21	do.

A moderately thick paste is made with the starch, by means of heat; into this paste, is thrown the gum arabic and the alum, which have been previously dissolved in water, and in separate vessels. The whole is mixed well together; and it is applied warm to the sheets of paper, by means of a brush, or a large, flat hair pencil. The paper may be coloured, by adding to the size a decoction of French berries, in the proportion of ten drachms. After having dried this autographic paper, it is put into a press, to flatten the sheets, and they are made smooth, by placing them, two at a time, on a stone, and passing them under the scraper of the lithographic press.

If, on trying this paper, it is found to have a tendency to blot, this inconvenience may be remedied, by rubbing it with finely pounded sardarac. We give below another recipe, which will be found equally useful, and which has the advantage of being applicable to thin paper, which has been sized. It requires only that the paper be of a firm texture.

Gum tragacanth, - -	4	drachms.
German glue, - - -	4	do.
Spanish white, - -	8	do.
Starch, - - - -	4	do.

The tragacanth is to be put into a large quantity of water, to dissolve, thirty-six hours before it is mixed with the other materials. The glue is to be melted over the fire, in the usual manner. A paste is made with the starch; and after having, whilst warm, mixed these several ingredients, the Spanish white is to be added to them, and a layer of this sizing is to be spread over the paper, as already described; taking care to agitate the mixture with the brush, to the bottom of the vessel, that the Spanish white may be equally distributed throughout the liquid. We will hereafter point out the manner in which it is necessary to proceed, in order to transfer writings, or drawings.

We must not omit to notice two autographic processes which facilitate, and abridge, this kind of work, when it is desired to copy a *fac simile*, or a drawing in lines. The first of these methods, is to trace, with autographic ink, any subject whatever, on a transparent paper, which is free from grease and from resin, like that which, in commerce, is known by the name of *papier végétal*, and to transfer it to stone; this paper to be covered with a transparent size; this operation is very difficult to execute, and requires much address, in consequence of the great tendency which this paper has to cockle, or wrinkle, when it is wetted. Great facilities will be found from using tissue paper, impregnated with a fine white varnish, and afterwards sized over. In the second process, transparent leaves, formed of gelatin, or fish glue,* are employed, and the design is traced on them, with the dry point, so as to make an incision; these traces are to be filled up with autographic ink, and thence transferred. We will describe, in their proper places, these processes, as well as that of transferring a lithographic, or a copperplate engraving.

A Notice of a new Engine, possessing great power, now constructing in the vicinity of this city.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—Believing that any information relative to the progress of improvement in the mechanic arts will be acceptable to you, I send you some intelligence respecting a machine which will soon be before the public.

A person residing in the neighbourhood of this city, has nearly completed a small engine, which, in my opinion, will combine safety, simplicity, and economy, in a degree surpassing any of the steam engines now in use; and even those promised in the Franklin Journal of June last. As the engine of which I speak will soon be ready for public inspection, when you will have an opportunity of judging for yourself, I will not now attempt to describe its structure, but merely state some of the advantages which I believe it will present.

It will be free from the heat and the danger which accompany highly elastic steam, as in the engine of Perkins; and from the tremulous motion, and the rumbling noise, produced by that of Brown. It will occupy but little space, probably less than that of Perkins, and is so silent, that it will scarcely be heard. There is no fire, no boiling water, no burning of gas. It is light, simple, and efficient; dissipating, at first sight, all those apprehensions which other engines are calculated to excite. It can be regulated so as to work with a pressure of from one to six hundred pounds upon the square inch, with a very moderate strain on any given part of the machinery. The ingenious inventor, whose name will appear in due time, pledges himself, that an engine of sixty horse power shall be kept at work, night and day, for one month, at a cost not exceeding ten dollars.

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* The manner of preparing these leaves shall be hereafter given.

Before closing, I will state, that the obstacles which existed in Brown's gas engine, have been entirely overcome, as will be made evident to the citizens of Philadelphia, before many weeks are passed; the public therefore might do well to suspend its judgment, respecting this machine, notwithstanding the positive manner in which it has been denounced.

Respectfully, &c.

Joshua Shaw.

Philadelphia, July 10*th*, 1827.

On the advantages of employing small Cupola Furnaces in Iron-founding. *By* Thos. Gill, Esq.

In our last volume, page 174, we mentioned that an eminent iron-founder and engineer in London had lately caused a cupola-furnace to be lined to the internal "diameter of *seven inches only* at the basin, although it widened above in a conical form, for the sake of holding more coke."

We have since been highly gratified by the information, that in this small furnace, intended chiefly for small jobs, on a sudden emergency, *they have been able to run down thirty-three hundred weight of cast-iron in a day, and with one half only of the coke usually employed in the larger cupola-furnaces!*

We need hardly add, that they will always continue to employ this small furnace, in preference to a larger, where it will contain a sufficient quantity of iron for their castings; as it not only saves so much fuel, but also melts the iron in a much less time, and consequently with a less expenditure of power to work the bellows.

In plate 2, fig. 6, we have given a figure of this small, hexagonal, cupola-furnace, the outside of which consists of a set of six, nearly similar, cast-iron plates, bound together with screwed hoops of wrought-iron, and lined internally with fire-bricks and road-dust. *It is only five feet in height, but will run down one and a half, or two, hundred weight of cast-iron in half an hour's time.*

It is the intention of this founder, in case of erecting another furnace, to make it a foot, or a foot and a half, higher than the present one. The bellows, are a pair of the larger smiths' bellows, the pipe is two inches internal diameter, and they are worked, rather quick, by means of a crank. There are two circular orifices in the back plate of the furnace, to admit the blast, fully as wide as the bore of the bellows-pipe, and placed one above the other, in order to use either the one or the other of them, to make the basin more or less deep, according to the quantity of iron to be melted.

[*Technical Repository.*

List of Patents granted in the United States, in February and March, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

In the method of making copperas; Isaac Tyson, Baltimore, February 15.

In the washing machine; Chester Stone, New Haven, Connecticut, Feb. 17.

In a mode of preventing moths, or worms, from destroying hides, skins, furs, and peltry of all kinds; Samuel Storm, New York, Feb. 17.

In the machine for grinding or mixing earth, for making bricks; Benjamin K. Hill, Richmond county, Georgia, Feb. 17.

In the hay, and grain, horse-rake; Moses and Samuel Pennock, Pennsylvania, Feb. 17.

In the machine for pressing cotton, &c.; Philemon White, Chatham county, N. Carolina, Feb. 19.

In the mode of constructing locks, or door fastenings, &c.; John Brown and George W. Robinson, Providence, R. Island, Feb. 20.

In the plough; Ryland Rodes, Charlottesville, Albemarle county, Virginia, Feb. 20.

In the percussion gun-lock, for rifles, &c.; William A. Hart, Fredonia, N. York, Feb. 20.

In making salt; Benajah Byington, Salina, New York, Feb. 21.

In the art of building and constructing ships, &c.; Thomas W. Bakewell, Cincinnati, Ohio, Feb. 21.

In the machine for clearing grounds of logs and brush; Squire Collins, Hillsdale, Columbia county, New York, Feb. 22.

In the art of inlaying gold or any other metal, in turtle or tortoise-shell and horn, for various ornamental and fancy articles; Uriah Bailey, Massachusetts, Feb. 22.

In manufacturing andirons; Edward Smylie, New York, Feb. 22.

In the manufacture of suspenders; A. L. Van Horn, Philadelphia, Feb. 22.

In the pump, used for steam-boilers; Alfred Judson, New York, Feb. 23.

In bedsteads; Chester Johnson, New York, Feb. 24.

In the bee-hive; C. Wiggins, Pennsylvania, Feb. 27.

In the grist mill; Benjamin Overman, N. Carolina, Feb. 28.

In finishing paper; Ira White, and Leonard Gale, Vermont, Feb. 28.

In cutting garments; James G. Wilson, New York, Feb. 28.

In propelling boats; E. Fuller, R. Island, March 2.

In the mode of blowing and striking for blacksmiths; L. Hoyt, and E. Pierce, New York, March 3.

In laying ropes, called the combined jacks, rope layer, and breastwork; David Myerle, Philadelphia, March 3.

In making watch seals; S. Davis, H. P. Babbitt, and B. B. Grinnell, Providence, Rhode Island, March 3.

In making shovels; Oliver Ames, Massachusetts, March 5.

In the machine for turning tenons; John W. Sweet and William Stedman, Massachusetts, March 5.

In the machine for grinding apples; H. E. Paine and S. H. Russel, Ohio, March 5.

In bridges; William Woodmansee, New York, March 6.

In the machine for shearing cloth; James Collins, Maine, March 6.

In the water wheel for saw-mills; Thomas Shute, Tennessee, March 6.

In a machine for cutting metallic and other hard substances; John H. Hall, Virginia, March 7.

In the spring hammer, for blacksmiths; James Rainey, North Carolina, March 7.

In a composition of matter with which marbles, granites, and stones of all descriptions are perfectly imitated; Louis Matthy, New York, March 7.

In inserting, or ingrafting, teeth; E. A. Bigelow, Vermont, March 8.

In spur or bevel gearing for mills, &c. Charles Neer, Waterford, Saratoga county, New York, March 9.

In crank and wheel dampers for chimneys; James Reilly, and John Flanagan, Waynesburg, Franklin county, Penn., March 10.

In the horizontal wind mill; Jonathan Reynolds, America, Dutchess county, N. York, March 15.

In the machine for cutting straw, &c. Calvin Chamberlin, America, Dutchess county, N. York, March 15.

In the manufacture of hatter's cards or jacks; Joseph C. Seely, Dutchess county, N. York, March 15.

In the mode of constructing the feet of brass andirons, &c.; John Griffiths, N. York, March 15.

In an instrument called the wheelwright's assistant for turning and boring hubs, &c.; Cyrus W. Beach, Schoharie, N. York, March 16.

In shelling corn; George E. Waring, Westchester county, N. York, March 16.

In extracting alcohol from common proof spirits, by the use of steam; A. Wolcott, and N. Wolcott, Bloomfield, Ontario county, N. York, March 19.

In a spring temple, for looms; A. Jenks, and J. Clewell, Holmesburg, near Philadelphia, March 19.

In the grist mill crusher and sheller; John G. Morse, Randolph county, N. C. March 20.

In the machine for making bricks; David Rising, Alchester, Vermont, March 21.

NOTICES.

Franklin Institute Exhibition.

Manufacturers, and others, who propose to send articles to the next annual exhibition, are reminded, that they may be deposited at the Hall of the Institute, at any time, between the 1st of August, and 1st day of October.

Much inconvenience has heretofore resulted from the late arrival of goods; it is hoped, therefore, that exhibiters will be prompt in sending, as it will otherwise be impossible so to arrange the different articles, as to display them to the most advantage. The exhibition will open on Wednesday, the 3d day of October.

It is requested that those who exhibit articles, will affix their names to them; and such as are for sale, should have in addition, their price, and the residence of the vender.

Further information may be obtained, on applying by letter, *post paid*, to either of the members of the committee of arrangement, which consists of the following gentlemen—James Ronaldson, Adam Ramage, Thomas Fletcher, A. G. Ralston, Abraham Miller, Samuel J. Robbins.

Micaceous Sand, or decomposed Mica, and Fire-bricks.

Colonel Robert Carr, at the Botanic garden, near the lower ferry, on the banks of the Schuylkill, has discovered, upon his grounds, extensive beds of this article: from its abundance, and its vicinity to the river, he will be able to deliver it at any of the wharves on the Schuylkill, at about half the price at which it has heretofore been furnished.

We are credibly informed that fire-brick has been made here, by the aid of this article, in every respect equal to the best Stourbridge bricks; such certainly is not usually the case, and the brick-maker who should succeed, in producing, uniformly, such an article, might secure a very lucrative business.

A very good fire-brick, is made in Baltimore, from earth dug up on the basin, in the immediate vicinity of the iron foundries. We are assured that these bricks are superior to the imported, and we have *seen* reason to credit the assurance. We have by us, a specimen of the brick, and of the earth from which it is made.

To Postmasters.

Postmasters, at whose offices numbers of this Journal may remain unclaimed, are particularly requested to return them to Mr. Dobson, the publisher.

To Subscribers.

The few who have paid, or forwarded, their subscription for the present year, have the thanks of the publisher; the many from whom it is due, he hopes will soon elicit his gratitude.

Fig. 2

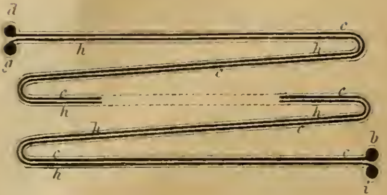


Fig. 1.

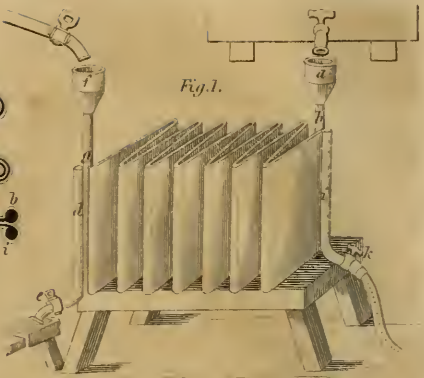


Fig. 3.

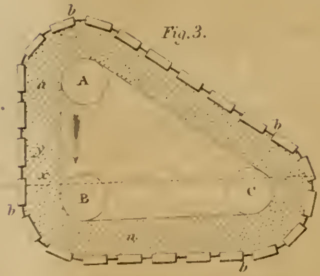


Fig. 4.

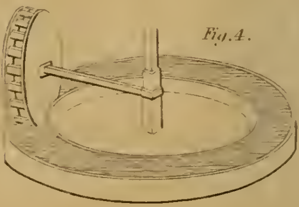


Fig. 5.

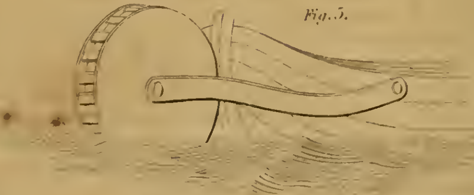


Fig. 6

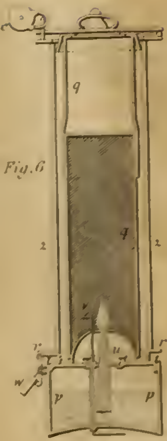


Fig. 7

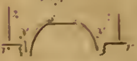


Fig. 8.

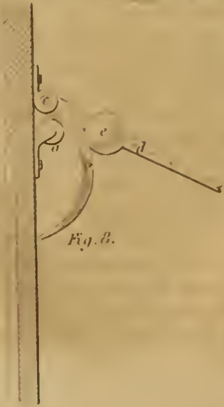
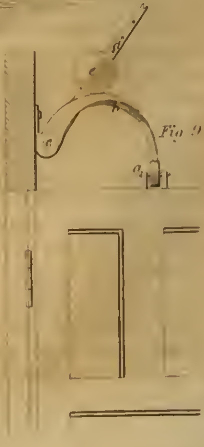


Fig. 9



Eng.d by R. Campbell

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

SEPTEMBER, 1827.

Essay on Earthenware and Porcelain.

[From Parkes' Chemical Essays.]

(Continued from p. 79.)

Before I proceed to a descriptive detail of the several processes in the manufactory of earthenware, it will be proper to say a few words on the nature of the different materials which are usually employed to form the body of the ware itself.

It is well known that the chief ingredients are clay and flint; the former of which, when pure, is known to chemists by the name of *alumina*, and the latter by the name of *silica;* and that no kind of earthenware can ever be perfect, unless it be made of a suitable sort of clay, and in that proportion only, which shall be correspondent to the quantity of flint employed. The experience of ages has confirmed this, and has proved that good pottery, as Vauquelin has remarked, differs from bad, less in the diversity of its elements, than in their proportions. How crude have been the notions of men respecting the chemical nature of bodies! The great Buffon "considered clay to be merely silica attenuated, and, as it were, rotted by the action of water, the air, and the sun."

Baumé was of opinion that sulphuric acid is a component part of all clays, and that the difference which is observable in different samples of this earth is chiefly owing to variation in the quantity of this acid—but this opinion is also erroneous.

There are four kinds of clay in common use in the Staffordshire potteries, and they are known by the following appellations, viz *Black* clay, *Cracking* clay, *Brown* clay, and *Blue* clay. The two former are the produce of the south of Devonshire, the others are brought from the Isle of Purbeck in the county of Dorset. With regard to the price of these clays, that of the two first is 14*s*. per ton, delivered on board the vessel, or 44*s*. when delivered in the potteries. The price of the two latter is 21*s*. on board, or from 48*s*. to 52*s*. per ton, when delivered to the works.

The *black clay* takes its name from the colour which it usually bears, and this is derived from a quantity of bitumen or coaly matter which it contains. This carbonaceous portion is, however, entirely consumed when the clay passes through the potter's oven, for the articles made with it become, when properly fired, of a good white.* It is, indeed, a curious fact, that the blacker this clay is when it is first dug, the more white will the earthenware be, which is made with it.

The second kind, called *cracking*, has acquired its name from a property which it has of occasioning the ware to crack during the first process of burning, or while making it into biscuit, if by accident a larger quantity than usual of it has been employed. But notwithstanding this singular property, the manufacturers are fond of it, on account of its extreme whiteness. It is, however, always dangerous to use it, unless it be employed with judgment, because it has a peculiar tendency to crack even when mixed with the usual proportion of silica. Every kind of clay, when dried without any admixture, will be liable to this inconvenience; because, if *pure* argillaceous earth be made sufficiently soft to be modelled by the potter's wheel, it will shrink one inch in twelve during the process of drying, and this will inevitably produce the effect in question.

The third kind which I have mentioned, is what is known by the name of *brown clay*. The excellency of this sort is, that it burns white, without danger of its cracking like the last species, although it is liable to another imperfection, which is termed *crazing*. Some manufacturers, however, employ this clay largely, while others, on account of this peculiar property, refuse it entirely.

Crazing is a technical term to denote the cracking of the glaze. It is believed that this generally arises from a defective union of the glaze with the body, owing to the clay, or the mixture of the clay with the other materials being ill calculated to receive the glaze properly. But may it not be occasioned rather by the glaze itself being not perfectly fusible? I suspect, however, that it more frequently originates from the circumstance of the ware being drawn out of the oven before it has time to cool gradually, and for the glass to become properly annealed. If lime be mixed with the materials which form the body of the ware, that will unavoidably occasion the crazing of the glaze.

The fourth kind, called *blue clay*, is considered to be the best, and, indeed, it always costs the highest price. This not only burns white, but it forms a very solid kind of ware, and will bear a larger proportion of flint than any other; and it is well known to potters, that the greater the quantity of silica, the whiter will be the earthenware; though if more of this species of earth should be employed than the clay will admit, it would occasion the goods to crack in the second burning. Both this and the brown clay are now much used for making porcelain.

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* The Roman potters must have learnt that the native clays differ very much in their nature and properties, for they had different names to distinguish them; such as *Argilla* for potter's clay; *Terra pinguis*, black clay; *Leucargillion*, white clay; *Terra sigillaris*, fine clay; and *Tasconium*, the clay for crucibles

It requires much practice to be enabled to understand the nature of clays sufficiently to employ them in pottery to the best advantage. Dr. Lewis, in his notes to Neumann's Chemistry, has given the results of many experiments on the mixture of clay with the different earths, and earthy compounds, for the purposes of making pottery, which may be read with advantage by those who are desirous of investigating this subject. Chaptal speaks of a white earth from Ayoree in North America, which the French potters employ. Would not this be of equal value to our manufacturers?

Silica, or pure flint, as I have stated above, is likewise an important article in the manufacture of earthenware; forming, in general, a fourth, a fifth, or a sixth part of the whole of the bulk of the prepared mixture, or paste, when taken by weight.

There is, however, one remarkable difference in the properties of silica and alumina, which has a very manifest effect on porcelain. Pure silica is transparent; but the thinnest lamina of alumina is entirely opaque.

Alumina has such an affinity for silica, that it will unite with it even in the humid way, and form a kind of mortar, which will harden by time, and be afterwards incapable of decomposition by the action of the atmosphere. This combination is the basis of many of the gems and precious stones.

Much of the flint used in England, is brought from the neighbourhood of Larne, in the county of Antrim, in Ireland; but as this comes out of a bed of limestone, it is not so good for the potter's use as the chalk flint. The price of the latter is at this time about 35*s*. per ton, delivered in the Staffordshire potteries. The flint which is most approved is procured chiefly from Gravesend, where it is found imbedded in the chalk.* It is usually sold at 40*s*. per ton, delivered at the works.

The English potters procure their flint on these low terms, because the people who are employed in Kent, and the neighbouring counties, in getting the limestone and chalk, are obliged to raise the flint also; which being in their way, the proprietors of the quarries are glad to get rid of it even at a very inferior price.

It has been suggested by a friend of mine, that an inexhaustible source, for supplying the manufacturers with very excellent flint, would be the sea-shore; and that a person conversant with chemistry might readily examine a few samples of pebbles, and determine which were most suitable for making good pottery.

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* Silica is also a component part of various other stones, and is the basis of rock crystal, quartz, agate, &c.

For making the finer kinds of earthenware, a considerable quantity of Cornish clay is also used, known commonly by the name of China-clay. This is the decomposed fel-spar of the granite; and it is prepared in Cornwall by the clay-merchants themselves, before it is transmitted to the Staffordshire potteries.

There are huge masses, or rather mountains, of white granite in Cornwall, and in some parts of the county, this is found to be partially decomposed; and it is where this is the case, that the mineral is raised and prepared for the purpose of making earthenware and porcelain, it having been discovered some years ago, by Mr. Cookworthy of Plymouth, that this mineral furnishes us with the true *kaolin*, and also with the *petuntse*, of the Chinese.

Granite is composed of quartz, fel-spar, and mica: and Mr. Gerhard found, in making an experiment on granite, that the fel-spar melted into a transparent glass; under it the mica lay in the form of a black slag, and the quartz remained unaltered.

To render the decomposing granite of Cornwall fit for the manufacturer, the following method is adopted. The stone is broken up by means of a pickaxe, and then thrown into a stream of running water. This washes off the light argillaceous parts and keeps them in suspension, whilst the quartz and the mica, thus separated, are allowed to subside near the place where the stone is first raised.

At the end of these rivulets are a certain kind of catch-pools, where the water is at last arrested, and time is allowed for the pure clay, with which the water is thus charged, to separate entirely from it. As soon as all the clay has subsided, the water is drawn out of these receptacles. The solid matter is then dug up in square blocks, and laid on what are called *linnees*, which are several connected series of strong shelves, erected so as to allow a proper circulation of air, in order that the clay may be more effectually dried for sale.

It is then packed in casks and sent to the Staffordshire potteries, and elsewhere, under the name of China-clay. Thus prepared, it is extremely white, and in the state of an impalpable powder. It may here be observed that none of the native clays are entirely free from foreign ingredients. If pure argillaceous earth be required, it can only be procured from alum, which may be dissolved in water, and then decomposed by an alkali. In this process, the pure clay will subside, which should then be thoroughly washed for use.

The price of these Cornish clays is considerably higher than that of any other kind; but for many of the finer purposes of pottery, they are absolutely indispensable. They are very smooth and ductile, and their extreme whiteness is very remarkable. It was analysed by Mr. Wedgwood, and found to consist of 60 parts alumina and 20 of silica.

The Cornish clay is also extremely useful for making crucibles, as it will not fuse by the addition of any of the common fluxes. In using these crucibles, however, they should always be put within others which are of little value; the inner ones will then acquire the heat gradually, otherwise they would be in great danger of breaking.

Besides the clays already mentioned, some of the Cornish granite itself is often used with the clay, on account of the binding quality which it possesses, and its knitting, as it were, the other materials more closely, by its fusibility; it being naturally more fusible than the earths usually employed in this manufactory: for it is a curious fact, that neither clay, silica, nor lime, will melt singly; but by mixing these three species in due proportions, the greatest degree of fusibility is acquired.

Having thus briefly described the several articles which are most commonly employed in making pottery, it will now be necessary to explain in what manner these are separately prepared for use.

The flints are managed in this way: they are first burnt in a kiln, constructed for the purpose, and somewhat similar in form to a common lime-kiln; and then they are ground between very hard stones, by a great power, which is given either by the water-wheel or by a steam-engine. In constructing the apparatus, the purity and hardness of the stones are of very material consequence; for should they contain calcareous earth, a portion of this would be abraded during the grinding of the flint, which would prove very detrimental to the pottery of which it formed a part.

To enable the operator to expedite the process, and at the same time to grind the flints finer, a quantity of water is thrown into the mill with them, so that the article, when finished, has much the appearance and the consistence of cream. The health of the workmen is also preserved by this expedient; for, before this method was adopted, the atmosphere of the room often became charged with the finer particles of the flint, which, entering into the lungs, sometimes produced the most disastrous consequences.

The grinding the flint with water was first practised by the celebrated Brindley, well known for his skill in the construction of inland canals. The mills now in use were also invented by him; and are composed of a very hard siliceous stone, called chert, which is found in abundance in the neighbourhood of Bakewell in Derbyshire.

I have already hinted, that it is important to attend to the nature of the stone which is employed in these mills; and some years ago I was told of a very severe loss which was sustained by many of the large potters, in consequence of their having been supplied with great quantities of prepared flint which had been ground by stones containing a considerable portion of carbonate of lime, which being mixed with the flint, and eventually with the material itself, occasioned, to the body of manufacturers, a loss of many thousand pounds.

In order to prepare the clay, it is first mixed with water to the consistence of cream: the design of this is, that it may be the more easily passed through the sieves, and intimately united with the ground flint, which could not be done with uniformity, and certainty, if these earths were mixed dry.

The mixture of the clay and water, in the first instance, is generally effected by means of long wooden instruments, which the men move backwards and forwards with considerable force throughout the whole mass. It is an operation of great labour, and is distinguished by the term *blunging*.

The ground flint is mixed in a similar way, with water, and the stirring is continued until it become one uniform fluid mass. But these earths, the clay and the flint, are always blunged *separately;* because, if otherwise, and the two earths were mixed before being deprived of their impurities, which cannot be done till they are brought into a fluid state, it would be impossible to observe the requisite proportions of each.

The purification of these earths is effected by a process similar to that which the chemist calls Elutriation. When the earth has been well broken and thoroughly mixed with water, it is put into vats, or other large vessels; and when it has stood long enough for the grosser parts to subside, the fluid containing the finer particles is drawn off by a plug, and reserved for use.

In every preparation of these materials for the formation of earthenware or porcelain, it is of the utmost consequence to attend to the relative quantities of each: therefore, whenever these mixtures of the fluid clay with the flint are to be made, they are always done with some nicety, an attention being paid to the specific gravity of each of the fluids, which is either made heavier, or diluted further with water, as the case may require. The mixture of clay and water, after it has passed *once* through the sieve, is generally brought to the specific gravity of 24oz. the wine pint. A pint measure of the ground flint and water, when in the same state, is usually 32 ounces.

When the clay and the flint are mixed in suitable proportions, the whole mass, in this state of semifluidity, is passed through the sieves to take out any remaining impurities, and also to detain those particles which have not been sufficiently levigated. The mixture is then passed through the finest silk lawn, to ensure the certainty of no unbroken pieces remaining in it, and to reduce the whole to a state of the utmost uniformity and smoothness.

The next object is, to separate the water which has been employed with such profusion, and the readiest way of effecting this is found to be by the direct application of heat. The mass is therefore now poured into very long brick troughs, which are built with flues under them of a sufficient size to afford heat enough to produce an ebullition in the mixture; and this is continued until so much of the water is evaporated as will reduce the mass to the desired consistence.

The evaporation is, indeed, never carried beyond a certain point; because, if this mixture of the earths were allowed to become nearly dry, it would not be kneadable by the usual methods; neither could it be worked, by the hand, or the wheel, into any of those forms which it may be the intention, or interest, of the potter to impart to it.

I ought to have mentioned, that the mixture of the clay and the flint with water, is known in the trade by the name of *slip;* that the place in which it is kept is the *slip-house;* and the trough on which it is boiled is called the *slip-kiln.*

When the mixture has been thus brought to a proper consistence, it ought to be kept for a considerable time, that the materials may become more intimately united than they can ever be by mere mechanical force: but in general this is not much attended to, although every manufacturer is fully aware of its importance. Want of room, of time, and often of capital, occasions it to be sometimes used warm from the slip-kiln, and not uncommonly when it has been lying for a few hours, or days. In China, it is no unusual thing for the prepared clay to remain from 14 to 20 years, before it is thought to be in a fit state for use; and I have heard of some districts where it is customary for a father to prepare as much porcelain-clay as will be sufficient for the use of his son throughout the whole period of his life.

When the dried mass has been removed from the kiln, the next process is that of tempering it, which is effected by first beating it with mallets, and then turning it, and beating it again, and again, with small spades, or paddles, as the workmen call them, until it is thought to be as well tempered as it can be by these operations.

It should be recollected that this is not pure clay, but a mixture of all the ingredients. Vauquelin says that "Silex constantly forms at least two-thirds of most pottery; alumine from a fifth, to one-third; lime from one five-hundredth, to one twenty-hundredth part; and iron, from the minutest quantity, to twelve or fifteen per cent."

The mass, after the operation of beating, undergoes a process called *slapping*. For this purpose it is removed, in the state of large lumps, to a convenient bench or table, where a man having cut it across with a brass wire, unites it again by slapping one of the halves down upon the other, with all his force; he then cross-cuts it again and again, and as often unites it by main force, as before.

This cutting the clay in pieces and slapping it together, is a laborious operation; but it must always be continued until the air-bubbles, which the mass at first contained in great abundance, are all driven out of it; because, if the air was not thus carefully expelled from the clay, it would escape when it became rarified in the oven, and this would produce such blisters as would spoil the manufactured goods. On this account the slapping is continued until the mass exhibits, wherever it may be cut, a perfectly smooth and homogeneous surface.

Of late years Mr. Wedgwood and some other considerable potters have, however, employed an apparatus invented by Mr. Thomas Lowe of Nottingham, which effects all these purposes at once. It is moved by a steam-engine, and performs all these operations with a surprising economy of time and labour. It first breaks the burnt flint; it then grinds it in water, and another part of the apparatus performs the hitherto laborious operation of blunging* the clay in water, and breaking it into a semi-fluid and uniform mass. When this is done, it is run off and sifted by several sieves of different degrees of fineness, all which are moved by the same power. This earthy fluid then runs down to a lower room, where it goes through other sieves in the same way. In like manner, another part of the apparatus squeezes the dried clay, to save the expensive operation of *slapping*, described at page 151; after which it passes to an iron cylinder, full of knives, where it is cut into pieces with great expedition; which saves the expense of cutting it by hand with brass wires, as before mentioned. This receptacle is not properly a cylinder, but a large hollow inverted cone of iron, and the knives are fixed in an upright shaft which revolves within it and passes through its centre. These knives are so contrived that the clay, as it is cut, is forced lower and lower by every revolution, until at last it is pressed by the power of the machinery through a square hole near the bottom of the apparatus, from whence it is removed as it falls, and is carried in blocks to the other parts of the manufactory.

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* This is the technical term, but doubtless it is a corruption of the word *plunging*.

The clay having undergone those varied operations, it is now fit for being formed into any shape, or employed for any purpose, for which it is designed. Accordingly, it is fashioned into various forms by means of a variety of moulds made of plaster of Paris; or put into as great a diversity of shapes by the potter's wheel.

[TO BE CONTINUED.]

ESSAYS ON BLEACHING.

By James Rennie, A. M., Lecturer on Philosophy, &c. &c. London.

No. IV.—CHEMICAL AND PHYSICAL NATURE OF STUFFS.

(Continued.)

2. *Wool.*—For our knowledge of the texture and composition of this important material of the cloth manufacture, we are greatly indebted to Detubenton. The qualities of wool as to length and tenuity of fibre, vary according to the parts of the animal whence it may have been taken; to the breed of sheep from which it is produced; the climate where they live; the pasture where they feed; and according as the animals are healthy or diseased. That which grows on the neck, the sides, and the back, is the finest part of the fleece, and fortunately the most abundant. The best breeds are found to degenerate in certain climates, and certain pastures, of which we have an illustrative instance in the European breed, in some places of America, which now produce hair, instead of wool. This seems to depend on the same general principle with the effects produced on wool by the diseases of the animals, the most healthy always affording the best—for change of climate, and food, may alter the constitutional secretions, as much as disease. Great attention has lately been paid in Britain to those circumstances which affect the qualities of wool, and great improvements have been made by the sheep farmers. This is of much importance, as we are indebted to Spain for all our finest wools. As the fineness of wool cannot be accurately ascertained by simple inspection, the manufacturer ought to compare by means of a microscope, the different specimens which may be offered to his purchase. When the wool is in its natural state, it is protected from moisture by a substance of a soapy nature, called *yolk* by the English, and *eck*

in Scotland. This, according to M. Vauquelin, (Ann. de Chim. xlvii. 276,) consists of a basis of potash combined with an animal oil, together with lime united to the carbonic, acetic, and muriatic acids. This nutritious matter is always most abundant on the wool of healthy sheep.

Mr. Mushet found, that after distilling in the dry way 180 grains of pure white wool, there remained a residuum coal, of a dark shining gray colour, welded, or caked, into one mass, adhering in part to the sides of the retort. It weighed only 43 grains, having lost in distillation 137 grains. In 100 parts, therefore, are contained 76 volatile matter, and 23.89 oxide of carbon.

The mechanical structure of wool is worthy of attention, both as an object of curiosity, and as, probably, of some importance in explaining the rationale of bleaching it. This structure was first described by the abbe Monge, (Ann. de Chim. vi. 300;—see also Nich. quarto Journ. i.) he having discovered it when examining the process of fulling. According to this philosopher, the fibres of wool consist, either of *laminæ* lying in a slanting manner upon one another, from the root to the extremity, somewhat like the scales of a fish, or of a series of rings gradually decreasing in diameter from the root to the point, and overlapping one another, as in the horns of animals. M. Monge states, and his statement is repeated by Bancroft, and in the Edinburgh Encyclopedia, that this structure may be perceived by drawing a fibre between the thumb and finger, from the point towards the root, in which case a tremulous motion, it is said, will be distinctly felt, accompanied with a sensible grating noise. Now I am disposed to controvert this; for upon repeated trials, with fibres of every degree of fineness, I could neither feel the motion nor hear the grating. This cannot even be perceived in the coarse hairs of cows and horses, though those have a similar structure. The only way by which it can be made sensible, is with a microscope, or by putting a hair between the finger and thumb, and moving them gently one upon another, when the fibre will move forward, or backward, according as the point, or the root, is placed anterior, or posterior, to the part by which it is held. This property of hairs has been long known to some of our peasants, who take advantage of it to excite the wonder of the ignorant, by telling the root, or the point, of any hair, although it be cut into ever so many pieces. It is on this structure that fulling and felting depend; it is to smooth the asperities caused by it, that spinners grease their wool; and it is in the interstices of these laminæ, that the colouring matter, which it is our object to find a method of removing, is lodged. The laminæ seem to be elastic, and, consequently, the pores must be dilatable by heat. This it may be useful to remember.

3. *Cotton.*—This substance is a down contained in the pods of the *gossypia* of Linnæus. This down is different in the different species, both in fineness and colour. In most it is white, of different shades; but that from which the nankin is made, is what Werner would call Sienna yellow, or bufforauge: a sort is mentioned as growing in Dahomy of a bright yellow; and several kinds, having

different shades of red, have been described. The coloured sorts, however, are not common, and the chief difference between one sort and another, seems to consist in the length, tenuity, and strength of the filaments. Naturalists do not seem to have ascertained with accuracy, the structure of these filaments. The microscope, according to Lewenhoeck, shows that they have two sharp sides. It certainly possesses some kind of asperities, or how can we account for the irritation which it produces when used in dressing wounds? In this it is totally different from lint. Perhaps this irritating action may be accounted for from the filaments being shorter than those of flax, and consequently presenting a greater number of points on the surface of the cloth. Dr. Thomson found the specific heat of cotton to be 0.53, that of water being 1, but from the difficulty of ascertaining this, he does not state it with confidence. (Ann. of Phil. II. 27.)

We learn something of the composition of cotton from Mr. Mushet's experiments on dry distillation. (Phil. Mag. XXXIII. 9.) He distilled 263 grains of the cloth which had been previously bleached. It emitted, during the operation, a quantity of pale blue flame, and left, as a residuum, a light friable coal, possessing the original shape and texture of the cloth, which weighed 39 grains—loss, 124 grains. It appears, then, that a hundred parts consisted of 85.16 volatile matter, and 14.84 of carbon; being 16.16 less carbon than is contained in as much silk, and 9.05 less than exists in pure wool.

The fibres of cotton, according to Nicholson, (Dict. of Chem. art. vegetables,) are insoluble in water, in alcohol, or in ether; but soluble in alkalies. It follows, of course, that strong alkaline leys will injure the texture of cotton goods in the process of bleaching. When treated with the nitric acid, cotton yields the oxalic. There seems to be in cotton, none of that particular resinous kind of matter which constitutes or contains the colouring matter of unbleached linen.*

4. *Linen.*—The mode of preparing flax, for the linen manufacture, has already been cursorily mentioned, when treating of water, and I shall not repeat what was then stated. The flax, when taken from the field, is put into ponds of standing water to steep, and stones are laid above it, to keep it from floating. When no such ponds are to be had, it is put into those parts of running water where there is little current, or little streams are banked up for the purpose. None of these, however, answer so well as ponds, for the process is both more tedious and more uncertain. The intention of steeping is to dissolve the oily or mucilaginous substance which makes the bark adhere to the woody part of the flax, and thus to effect a separation of the latter. This intention is answered by the putrefactive fermentation,

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* Des Charmes, however, (p. 106,) ascribes to such a resin, or to an oil or a gum, existing in cotton, the difficulty with which it imbibes water. Des Charmes remarks also, that though it may not appear foul, yet it never fails to render, by its impurities, the water in which it may be macerated, of a darkish colour. As it imbibes water with difficulty, it also retains it with some obstinacy, and before bleaching, is found to be long in drying. This may be countenanced by an observation of Mr. T. Henry's, (Man. Mem. iii.) that it imbibes water much more readily after it has been bleached than before.

which steeping induces, for it renders the oil and the mucilage soluble in water. It requires some nicety, however, to know when the putrefactive process has accomplished its purpose, for the flax will be equally useless if it has been steeped too much, or too little. In the one case the fibres will not be separable, or black bars in the linen will be the consequence, whose numbers increase with the deficiency in steeping, and which, in bleaching, are very difficult to remove. In the other, they will be destroyed, or very much weakened, by losing their tenacity. Now, the length of time which flax has been in the pond, can give no criterion of this, for the putrefactive fermentation depends much on other circumstances, such as the nature of the flax, its quantity, the heat of the weather, the length of the nights, the pressure of the stones laid upon it, and the quality of the water. The quickness or slowness of the fermentation, then, must be the measure of the time of steeping. On the second or third day, when the weather is warm, a great many air bubbles arise to the surface of the water, and a scum, or pellicle, is gradually formed. The temperature of the water increases, and it acquires a corrupted smell. The flax ought to be inspected every six hours, after the fourth day; and as soon as a glutinous or oily matter is perceived on the outer bark, and when this separates easily from the woody part, it ought to be taken out. But it ought not to lie till this separation becomes too easy, as this will be better completed by exposing it to the dew. Steeping ought always to be performed in a place much sheltered from the winds, as the process is checked by nothing so much as by agitation and cold, while it is greatly promoted by quietness and heat. For this reason also, the ponds ought not to be too shallow, as in that case they are more liable to be affected by changes of temperature. The flax ought not to touch the bottom of the pond, otherwise what is below will perhaps be rotten, in consequence of the superincumbent pressure, before that at the surface is nearly watered. This process appears, then, to be extremely difficult in management; and by it is produced a great deal of that brown colouring matter, which it is the object of the bleacher to remove.* Mr. Lee's method of preparing flax, which has been before stated, is not liable either to difficulty of management, nor to its injurious effects, and bids fair to supersede the process of steeping, altogether.

The nature of the colouring matter of brown linen, whether it exist naturally in the flax, or be acquired by steeping, has been accurately investigated by Dr. Kirwan, in the Transactions of the Royal Irish Academy, Vol. III. He made his experiments upon ley, saturated with this matter, which he procured from the bleachers. This liquor was turbid, of a reddish brown colour, having a strong smell and exhibiting no indication of acidity, or alkalescence. It did not effervesce with the muriatic acid, but afforded with it a copious precipitate, leaving a supernatant liquor of a red amber colour. When this is drawn off by a syphon, and the precipitate treated pretty copiously with water, agitating the whole, and again allowing it to subside, the floating liquor exhibits evident signs of acidity, and continues reddish, giving room to suppose that it contains a peculiar acid. After copious effusions of cold water, and when the precipitate is thrown on a filter and suffered to dry partially, it is of a dark greenish colour, and nearly of the consistence of moist clay. This was not dissolved when treated with sixty times its own weight of boiling water. If dried in a sand heat, it assumes a shining black colour, but when broken, shows a greenish yellow fracture, and becomes more brittle. On this the following experiments were made: 1, Having digested a portion of it in rectified spirit of wine, it communicated to it a reddish hue, and was in a great measure dissolved; but by the effusion of distilled water, the solution became milky, and a white deposite was gradually formed: the black matter dissolved in the same manner. 2, Neither the green nor the black matter was soluble in oil of turpentine, or linseed, oil, by a long continued digestion. 3, The black matter being placed on a red hot iron, burned with a yellow flame and a black smoke, leaving a carbonaceous residuum. 4, The green matter being put into the sulphuric, muriatic, and nitric acids, communicated a brownish tinge to the two former, and a greenish to the latter, but did not seem in the least to be diminished. We infer from this, that the matter extracted by the alkalies from brown linen, is a peculiar sort of resin, differing from the pure resins only by its insolubility in essential oils, and agreeing in this respect with lacs. In examining the action of alkalies on this matter, 8 grains of it were digested in a solution of crystals of soda, saturated to the temperature of 60°, which instantly communicated to the solution a dark brown colour; two measures, each of which would contain 11 dwts. of water, did not entirely dissolve this substance. Two measures of mild vegetable alkali, dissolved the whole. One measure of caustic soda, of the specific gravity of 1.053, dissolved nearly the whole, leaving only a white residuum. One measure of caustic potash, of the specific gravity of 1.039, dissolved the whole. One measure of liver of sulphur, (sulphuret of potash or soda,) whose specific gravity was 1.070, dissolved the whole. One measure of caustic volatile alkali, dissolved also a portion of this matter. Three ounces of the solution of Windsor soap, dissolved 8 grains of the colouring matter. It was found also that 4.2 grains of the saline substance of kelp, produced the same effect as 75 of that from Dantzic pearl ash, 38 of that from barilla, 15 of that from cashup, and 213 of soap. The sulphuret of lime was found to act very feebly on it. It follows from these experiments, that sulphuret of potash, or soda, is of all the alkaline compounds the strongest solvent of the colouring matter; next to this the caustic vegetable, and after this the caustic mineral alkali; the mild alkalies occupy the least place. Hence, the solutions of kelp, cashup, and markoff, are advantageously used in the first processes of bleaching, for which Dantzic ashes and sweet barilla are less fit. The experiments, however, show that six tons of kelp will be necessary to produce the same effect as one ton of cashup.

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* With regard to colours so produced, Chaptal has made a general remark of some importance, namely, that all colouring matter, arising from fermentation, are less soluble in water than in alkalies. He illustrates this by referring to the well-known dye-stuffs, indigo, woad, and annotta. Boiling water dissolves only a ninth part of its weight of indigo; woad communicates very little colour to water; and annotta can scarely be dissolved in it at all without the aid of an alkali. Water, then, it will follow by analogy, confirmed, as we shall immediately see, by experiment, will have but little effect on the colour acquired by flax in the putrid fermentation induced by steeping.

It was found by Mr. Mushet, that flax contained more carbonaceous matter than cotton. His experiments were made by dry distillation. When he treated 397 grains of flax in this way, after a copious discharge of white flame, a soft inflammable coal was left as a residuum in the retort. The original vegetable fibre remained entire, and equally compact as to form and bulk, as when introduced. It weighed 65 grains, having lost by the process 332 grains. A hundred parts are therefore composed of 83.62 volatile matter, and 16.38 of carbon. (Phil. Mag. XXIII. 8.)

NO. V.—PROCESSES FOLLOWED IN BLEACHING.

SECTION I.

By the arrangement which I have adopted, many of the details which, in most of the treatises on Bleaching are given under the present head, have been anticipated, a circumstance which, I hope, will render our account of the processes more perspicuous than it could otherwise have been made; it will, at least, make it shorter. An outline of the processes of bleaching followed about half a century ago will be found in the history, p. 207, vol. ii. by comparing which with the following, an idea may be formed of the rapid march of improvement. I begin with the processes for bleaching piece goods and heavy cotton cloths, which do not materially differ, except in the repetition of immersions, the cottons requiring fewer than the linens.

1. *Steeping.*—This process is intended to remove, without the expense of fresh alkaline ley, the impurities which the goods may have contracted in passing through the previous stages of manufacture from the spinner and the weaver, and which the subsequent management might tend to fix. Flax is mostly spun by hand, and the spinner constantly moistens it with saliva to make it draw out more readily to the proper grist. Now as saliva is known to be a more universal solvent than even water, we may infer that many impurities may, by this means, be fixed in the yarn. It will also, from its nature, form, when dry, a pellicle of tenacious matter on the surface of the threads, and may thus prevent the solvents from coming into contact with the colouring matters which are lodged in the body of the thread. Cotton again being spun by jennies and throstle frames is not liable to such regular contamination, but it is sometimes stained by the oil which is used for the machinery. Both are also filled with impurities by the weaver, who finds that he cannot make good work, unless he previously dress the yarn with some gelatinous matter that may give it a stronger adhesion. The linen weaver commonly uses for this purpose a sour paste, made from the seeds of oatmeal, which is applied with a brush to the yarn; and then tho-

roughly dried in, by passing a hot iron over the web. He then takes a brush, on which he has rubbed a small quantity of tallow, and goes over the whole. The cotton weaver seldom uses the flummery paste, but prefers one made of flour, or of mashed potatoes in a state of fermentation, and sometimes a mixture of both: and the combustibility of the cotton will not permit him to use so expeditious a mode of drying, as the hot iron affords. He dries his web with a large fan, and afterwards goes over it with the grease brush, in the same way as the linen weaver. I was astonished to read in Mr. Parkes' Essays on Bleaching, (Vol. IV. p. 121.) that the weaver "*melts a quantity of grease over his warp, which he afterwards spreads with a brush:*" a thing which I am persuaded no weaver would ever be so foolish as to try, as the parts where the grease fell would do away all the effects of the previous dressing. For this reason, weavers are always very careful not to rub too much grease on their brushes. Mr. Parkes must therefore find some more likely account of the origin of copper stains.

The small quantity of grease in the cloth, is fixed by the subsequent operation of singeing, when this is had recourse to; and if this is not taken out in the previous processes of bleaching, it will not yield afterwards to the usual processes of ashing and souring.

For the removal of these impurities, the first thing to be done is to have the cloth thoroughly washed, (with soap if necessary,) by the dash wheel, to get rid of what may be loosely attached to it. If time can be spared, it would render this washing more effectual to have the goods disposed in very open folds, to prevent unequal compression, and soaked in water, either in a trough, or in a running stream. (Des Charmes, p. 95.) They are next placed in similar foldings in a kieve which is filled with water, or waste alkaline, or soap leys, at a blood heat, with which they must be sufficiently covered, and held down by the cross bars formerly described; for they soon begin to swell and rise above the surface when this is neglected. Osier twigs must be placed at the bottom to prevent this swelling from causing too much pressure. A smaller degree of heat than that mentioned would not readily dissolve the dressing, and a greater might coagulate and fix it in the cloth. In a short time the dressing mixes with the water, and from its previous acidity induces the acetous fermentation. An intestine motion becomes perceptible, the temperature increases, and air bubbles are emitted, which by carrying up to the surface some of the light oleaginous particles, produce a thick scum. These effects, however, are gentle, and slow, as the dressing is in small quantity, in proportion to the water. The acid salts, according to Dr. Home, are no sooner separated by the acetous fermentation, from the absorbent earth which made them not perceptible to the tongue in their former state, than they are united to the oily particles of the tallow, which likewise adhere superficially, dissolve them and render them in some degree miscible with water. In this state they are soon washed off by the intestine motion of the liquor. This fermentation continues from twelve to eighteen hours, according to the state of the weather; but even in summer may be allowed, if we may trust Des Charmes, to go on without inconvenience for forty-eight hours. It is known to have continued the proper time, when an infinity of white bubbles are seen on the surface, and a fœtid smell is perceived; or when the goods have assumed a clear yellowish colour, instead of gray or brown. When no more air bubbles rise to support the scum, it separates, is precipitated, and would again become attached to the cloth, if not timeously removed. But greater danger may be apprehended from the putrid fermentation taking place, which would both weaken the texture of the cloth, perhaps rot it, and also generate and fix a dark colouring matter, that it might be difficult afterwards to remove. Attention to the indications now given will prevent such serious accidents.

There has been some discussion and difference of opinion respecting the liquid most proper for steeping. Waste alkaline leys are most commonly used, from our idea that they produce the strongest fermentation; but this, if it be the case, may arise from the impurities with which they are loaded. For fine calico bleaching they certainly ought not to be used, as indelible stains may be the consequence. The alkaline salts may attract the acid salts generated by the fermentation, and prevent their combination with the oleaginous impurities. On the contrary, if the alkaline salts are not previously saturated they may be of use in combining with, and carrying off the tallow. Dr. Home tried to come to some decision on this subject, but his experiments proved unsatisfactory. Des Charmes used milk of lime with advantage. He allowed the goods to remain in this liquid not longer than five or six hours, when they were found sufficiently prepared for the subsequent processes. Water, however, when time can be spared, is as efficacious as either this or an infusion of bran, which has also been recommended—to this a decided preference is given in Ireland.—(*Dub. Rept.* 1791.)

When the goods are found to be sufficiently steeped, the *steep* is to be drawn off and the goods taken to the squeezers, in order that all the loosened impurities may be pressed out. They are then taken to the dash wheel and washed till the water come off clear, when they are either wrung to such a degree that they may remain only moist, or are left to drain, on a proper stage. After rinsing or clearing piece goods subsequent to steeping, particular attention ought to be paid to rubbing them well with black soap, especially along their selvages, for this part being closer wrought than the rest requires to be particularly cleared to open it to the action of the succeeding detergents. When this is not attended to, it may probably be necessary, after the several operations, to rub them separately by hand, and the bleaching would be retarded by requiring several extraordinary immersions, to prevent these parts from being less perfectly white than the rest. Cottons which have received stains of oil are best cleared by a hot solution of black soap.

NATURAL HISTORY.

THE BEAVER.

[From Dr. Godman's Natural History.]

(*Continued from p.* 104.)

The beaver is a cleanly animal, and always leaves the house to attend to the calls of nature; the excrement being light, rises to the top of the water and soon separates and disappears. Thus, however great may be the number of individuals occupying the hut, no accumulation of filth of this kind occurs.

The beaver swims to considerable distances under water, but cannot remain for a long time without coming to the surface for air. They are therefore caught with greater ease, as they must either take refuge in their vaults or washes in the bank, or seek their huts again, for the sake of getting breath. They usually, when disturbed, fly from the huts to these vaults, which, although not so exposed to observation as their houses, are yet discovered with sufficient ease, and allow the occupant to be more readily captured than if he had remained in the ordinary habitation.

To capture beavers residing on a small river or creek, the Indians find it necessary to stake the stream across to prevent the animal from escaping, and then they try to ascertain where the vaults or washes in the banks are situated. This can only be done by those who are very experienced in such explorations, and is thus performed:—The hunter is furnished with an ice-chisel lashed to a handle four or five feet in length; with this instrument he strikes against the ice as he goes along the edge of the banks. The sound produced by the blow, informs him when he is opposite to one of these vaults. When one is discovered, a hole is cut through the ice, of sufficient size to admit a full grown beaver, and the search is continued until as many of the places of retreat are discovered as possible. During the time the most expert hunters are thus occupied, the others, with the women, are busy in breaking into the beaver houses, which, as may be supposed, from what has been already stated, is a task of some difficulty. The beavers, alarmed at the invasion of their dwelling, take to the water and swim with surprising swiftness to their retreats in the banks, but their entrance is betrayed to the hunters watching the holes in the ice, by the motion and discoloration of the water. The entrance is instantly closed with stakes of wood, and the beaver instead of finding shelter in his cave, is made prisoner and destroyed. The hunter then pulls the animal out, if within reach, by the introduction of his hand and arm, or by a hook designed for this use, fastened to a long handle. Beaver-houses found in lakes and other standing waters offer an easier prey to the hunters, as there is no occasion for staking the water across.

Among the Hudson's Bay Indians every hunter has the exclusive right to all the beavers caught in the washes discovered by him. Each individual on finding one, places some mark, as a pole, or the branch of a tree stuck up, in order to know his own. Beavers caught in any house, are also the property of the discoverer, who takes care to mark his claim, as in the case of the washes.*

The number of beavers killed in the northern parts of this country is exceedingly great, even at the present time, after the fur-trade has been carried on for so many years, and the most indiscriminate warfare waged uninterruptedly against the species. In the year 1820, 60,000 beaver skins were sold by the Hudson's Bay Company, which we can by no means suppose to be the whole number killed during the preceding season. If to these be added the quantities collected by the traders, from the Indians of the Missouri country, we may form some idea of the immense number of these animals which exist throughout the vast regions of the North and West.

It is a subject of regret, that an animal so valuable and prolific, should be hunted in a manner tending so evidently to the extermination of the species, when a little care and management on the part of those interested, might prevent unnecessary destruction, and increase the sources of their revenue. The old beavers are killed within a short time of their littering season, and with every such, from three, to six, are destroyed. The young are often killed before they have attained half their growth and value, and of necessity long before they have contributed to the continuance of their species. In a few years, comparatively speaking, the beaver has been exterminated in all the Atlantic, and in the western States as far as the middle and upper waters of the Missouri; while in the Hudson's Bay possessions they are becoming annually more scarce, and the race will eventually be extinguished throughout the whole continent. A few individuals may, for a time, elude the immediate violence of persecution, and like the degraded descendants of the aboriginals of the soil, be occasionally exhibited as melancholy mementos of tribes long previously whelmed in the fathomless gulf of avarice.

The Indians inhabiting the countries watered by the tributaries of the Missouri and Mississippi, take the beavers principally by trapping, and are generally supplied with steel-traps by the traders, who do not sell, but lend or hire them, in order to keep the Indians dependent upon themselves, and also to lay claim to the furs which they may procure. The name of the trader being stamped on the trap, it is equal to a certificate of enlistment, and indicates, when an Indian carries his furs to another trading establishment, that the individual wishes to avoid the payment of his debts. The business of trapping requires great experience and caution, as the senses of the beaver are very keen, and enable him to detect the recent presence of the hunter, by the slightest traces. It is necessary that the hands should be washed clean before the trap is handled and baited, and that every precaution should be employed to elude the vigilance of the animal.

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* Lewis and Clarke relate an instance which fell under their observation, of one beaver being caught in two traps, belonging to different owners, it having one paw in each. The proprietors of the traps were engaged in a contest for the beaver, when the above named distinguished travellers arrived, and settled the dispute between them, by an equitable arrangement.

The bait which is used to entice the beavers is prepared from the substance called castor *(castoreum)* obtained from the glandulous pouches of the male* animal, which contain sometimes from two to three ounces. The substance is called by the hunters bark-stone, and is squeezed gently into an open mouthed phial.

The contents of five or six of these castor bags are mixed with a nutmeg, twelve or fifteen cloves, and thirty grains of cinnamon, in fine powder, and then the whole is stirred up with as much whiskey as will give it the consistency of mustard prepared for the table. This mixture must be kept closely corked up, and in four or five days the odour becomes more powerful; with care it may be preserved for months without injury. Various other strong aromatics are sometimes used to increase the pungency of the odour. Some of this preparation, smeared on the bits of wood with which the traps are baited, will entice the beaver from a great distance.

The castor, whose odour is similar to tanners' ooze, gets the name of *bark* stone from its resemblance to finely powdered bark. The sacks containing it are about two inches in length. Behind these and between the skin and root of the tail, are found two other oval cysts, lying together, which contain a pure strong oil, of a rancid smell.

During the winter season the beaver becomes very fat, and its flesh is esteemed by the hunters to be excellent food. But those occasionally caught in the summer, are very thin, and unfit for the table. They lead so wandering a life at this season, and are so much exhausted by the collection of materials for building, or the winter's stock of provision, as well as by suckling their young, as to be generally at that time in a very poor condition. Their fur during the summer is of little value, and it is only in winter that it is to be obtained in that state which renders it so desirable to fur traders.

The different appearances of the fur, caused by age, season, disease, or accident, have at times led individuals to state the existence of several species of beaver in this country. No other species, however, has yet been discovered, but that whose habits we have been describing. Beavers are occasionally found nearly of a pure white, which is owing to the same cause that produces albino varieties of various animals. A specimen of the albino beaver may be seen in the Philadelphia Museum. *Hearne* saw but one such specimen during a residence of twenty years in the Hudson's bay country. This was considered a great curiosity, and no other was afterwards procured there during the ten ensuing years, notwithstanding he offered a large reward to the Indians for as many of the same colour as they could procure.

The traits of character exhibited by the beaver in captivity, are not very strikingly peculiar, though sufficiently interesting. It learns to obey the voice of its master, is pleased to be caressed, and cleanly in its habits. Hearne states that he has kept various individuals about his house, during his residence at Hudson's bay, and remarks, "they made not the least dirt, though they were kept in my own sitting room, where they were the constant companions of the Indian women and children, being so fond of their company that when the Indians were absent for any considerable time, the beaver discovered great signs of uneasiness, and on their return showed equal marks of pleasure by fondling on them, crawling into their laps, laying themselves on their backs, sitting erect like a squirrel, and behaving to them like children that see their parents but seldom." In general during the winter they lived upon the same food as the women did, and were remarkably fond of rice and plum-pudding. They would eat fresh venison and partridges very freely, but I never tried them with fish, though I have heard they will at times prey on them.*

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* Juxta preputium introque latere existunt.

[TO BE CONTINUED.]

FOR THE FRANKLIN JOURNAL.

On the causes of the inadequate protection afforded by Lightning Rods, in some cases, and the means of insuring their perfect competency: also, a refutation of the prevalent idea, that Metals are peculiarly attractive of Electricity. By R. Hare, M. D., *Professor of Chemistry in the University of Pennsylvania.*

In some of our American newspapers, a letter has been republished from the London Times, calculated, as I conceive, most perniciously to lessen the confidence of the public in metallic conductors, as a mean of protection against lightning. In common with many other persons, the author of the letter appears to suppose, that metals are peculiarly attractive of electricity; and infers that, when a metallic rod is attached to a house, or ship, a discharge of electric fluid may be induced from a cloud, which, otherwise, would not have been sufficiently near to endanger the premises. Nothing in my opinion can be more erroneous than this notion. The truth is, that the earth, and the thunder clouds being in opposite electrical states, the electric fluid tends to pass from one to the other, in order to restore the equilibrium. The atmosphere being a non-conductor, through which a discharge cannot be accomplished without a forcible displacement of air, any solid body rising above the earth's surface, which may be more capable than the air, of transmitting electricity, is made the medium of communication. Metals being pre-eminently capable of acting as conductors, the transmission of electricity is made through them, with proportionably greater facility. Yet they do not attract it more than other substances, similarly electrified. A glass, or wooden ball, is as readily attracted, by the excited conductor of an electrical machine, as a ball of metal; and as much more, than a metallic point, as the superficies of the ball, may be greater, than that of the point.

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* "It is well known that our domestic poultry will eat animal food; thousands of geese that come to London market are fattened on tallow craps, and our horses in Hudson's Bay would not only eat all kinds of animal food, but also drink freely of the wash or pot-liquor intended for the hogs. We are assured by the best authorities, that in Iceland not only black cattle, but also the sheep, are almost entirely fed on fish and fish-bones during the winter season. Even in the isles of Orkney, and that in the summer, the sheep attend the ebbing of the tide as regularly as the Esquimaux curlew, and go down to the shore which the tide has left, to feed on the sea-weed. This, however, is through *necessity*, for even the famous island of Pomona will not afford them an existence above high water mark." *Hearne, 8vo. p.* 245. It must always be borne in mind that observations made on the diet of captive animals will not at all apply to them when they are free to follow the dictates of nature. It is, however, highly interesting, to know how far they can accommodate themselves to necessity.

Nothing, to me, appears more unfounded than an idea, lately suggested, that the attraction between a ship, and a thunder cloud, can be increased, by the presence of a pointed metallic rod, surmounting the main-mast.

If houses, or vessels, have been struck with lightning, while provided with conductors, it is, in my opinion, owing to the conductors being improperly constructed; or having no adequate connexion with the earth. The power of any body to receive an electric discharge, is dependent on the conducting power of the medium in which it terminates, no less than upon its own. A metallic rod, held by a glass handle, or entering a mass of pounded glass, or dry sand, would not be more efficacious, as a conductor, than a glass rod similarly situated. If terminated by an imperfect conductor, as for instance by earth, or water, its power is reduced in proportion to the imperfection of the medium thus bounding it. This influence of the media, in which conductors terminate, has not been sufficiently insisted upon, in treatises on electricity. I should not consider a metallic rod, terminating, without any enlargement of surface, in the water, or the earth, as an adequate protection against lightning; but were such conductors to terminate in metallic sheets, buried in the earth, or immersed in the sea, or, *by a connexion duly made with the iron pipes, with which our city is watered, or the copper with which ships are generally sheathed,* I should have the most perfect confidence in their competency.

It is not only important that the points of contact, between the metallic mass, employed to afford lightning an adequate passage, and the earth, or water, in which it terminates, should be so multiplied as to compensate for the inferior conducting power of the earth, or water; but it is also necessary that the conducting rod be as continuous as possible. When conductors are to be stationary, as when applied to buildings, they should consist of pieces screwed together, or, preferably, joined by solder, as well as by screwing. Where flexibility is requisite, the joints should be neatly made, like those of the irons in fall top carriages; and should be rivetted so as to ensure a close contact at the junctures.

In all cases, the ordinary, but important, precaution of having the rod to terminate above, in a fine clean point, should be attended to. Where platina tips cannot be had, multiplying the points by splitting the rod into a ramification of pointed wires, may compensate for the diminution of conducting power, arising from rust.

The efficacy of the point, or points, is, however, dependent on the continuity of the conductor of which I have already spoken: since it is well known, that, if a pointed rod be cut into parts, so as to produce intervals, bounded by blunt terminations, its efficacy will not be much greater than if it had no point; because the fluid will, in that case, pass in sparks, instead of being transmitted in a current. It is on this account that I object to chains, or rods joined by loops, or hooks and eyes. The error of supposing that a metallic rod, must be more capable of attracting electricity injuriously, because of its known wonderful power in transmitting it, will be evident, when it is understood that the only difference between metals and other bodies, arises from the superior power of transmission. Hence, when by a defective communication with the earth or sea, the efficacy of the metal, as a conductor, is diminished, or destroyed, its influence over a charged cloud is proportionably lessened. It follows, therefore, that so far as it acts, its action must be beneficial, unless its lower termination should, by an inconceivable degree of ignorance or inattention, be so situated, as to render it more easy for the electrical fluid to leave the rod, and pass through a portion of the house or vessel, than to proceed, by means of the rod, into the earth or sea.

Thus Richman was killed by a conductor which he employed to receive electricity from the clouds, and to convey it to an electrometer, necessarily insulated: under these circumstances, the head of the professor being about a foot from the conductor, he became a part of the channel of communication with the earth. Had the apparatus been surrounded by a cage of wire, and this duly connected with a metallic rod soldered to a sheet of metal buried in the earth, Richman might have made his observations with perfect security. That with due precaution, experiments, analogous to his, are not productive of injury to the operator, is rendered evident by the subjoined quotation from Singer's Electricity.

I must premise, that the apparatus, by means of which the phenomena alluded to were produced, consisted of a wire a mile long, supported and insulated, upon very high poles, and terminating in the house of the electrician, Andrew Crosse, Esq.

"The approach of a charged cloud, produces sometimes positive, and at others negative signs, at first: but, whatever be the original character, the effect gradually increases to a certain extent, then decreases, and disappears, and is followed by the appearance of the opposite signs, which gradually extend beyond the former maximum, then decrease, terminate, and are again followed by the original electricity. These alternations are sometimes numerous, and are more or less rapid on different occasions; they usually increase in intensity at each repetition, and at last a full dense stream of sparks, issues from the atmospherical conductor to the receiving ball,* stopping at intervals, but returning with redoubled force. In this state a strong current of air proceeds from the wire and its connected apparatus; and none but a spectator can conceive the awful, though sublime, effect, of such phenomena. At every flash of lightning, an explosive stream, accompanied by a peculiar noise, passes between the balls of the apparatus, and enlightens, most brilliantly, every surrounding object, whilst these effects are heightened by the successive peals of thunder, and by the consciousness of so near an approach to its cause."

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* That is, a ball communicating with the earth, by an adequate metallic conductor.

"During the display of electric power, so awful to an ordinary observer, the electrician sits quietly in front of the apparatus, conducts the lightning in any required direction, and employs it to fuse wires, decompose fluids, or fire inflammable substances; and when the effects are too powerful, to attend to such experiments securely, he connects the insulated wire with the ground, and transmits the accumulated electricity with silence, and with safety."

FOR THE FRANKLIN JOURNAL.

Remarks upon Water Wheels, and upon some prevailing errors respecting the Application of water as a Motive Power.

I suppose that, at the present day, no man who professes to be capable of directing the construction of a water wheel, or of estimating the amount of a water power, is ignorant of the fact, that water falls through a distance of about sixteen feet in the first second. But I suspect that many who assume the above qualifications, do not know the ratio of increase, either of the distance, or the velocity. I have drawn this conclusion, not only from conversations with several practical engineers, but also from essays published in our scientific journals. As an instance of the latter, I will select, for its convenience of reference, an article on water wheels published in this Journal (Vol. I. p. 103.) which being the production of a practical engineer, and having passed the inspection of a scientific committee, may be considered as corroborating my commencing observations. In the third paragraph of that article, is the following sentence: "As a falling body, water descends at the *speed* of nearly 16 feet in the first second, and it will appear evident, that if a water wheel is required to be so driven, that the water with which it is loaded has to descend 10, 11, or 12 feet per second, at which rates wheels are generally constructed to work, that a *very large proportion* of the power is lost."

Here, in the first place, we find *speed*, or *velocity*, confounded with the *distance* fallen in the first second; whereas, the latter is 16 feet, and the former is accelerated, from nothing, at the commencement, to 32 feet per second, at the end of the first second; so that this part of the sentence conveys, strictly, no intelligible meaning; it is, nevertheless, made a standard, by a comparison between which, and any given velocity of a water wheel, we are to infer the loss of power sustained through excess of speed; thus, in the case of a wheel whose velocity is 10, or 12, feet per second, comparing these numbers with the mysterised number 16, the writer concludes, "that a very large proportion of the power is lost." The height of the fall which indicates the whole amount of the power, is not mentioned, but surely, to estimate the *proportion* between a defined part, and an undefined whole, is impossible.

The vague appreciation of first principles which I impute to this writer, is exhibited conclusively, in his closing remarks on certain establishments which he had inspected. At the corn mill on the Rariton, as well as at the flour mills on the Brandywine, he represents the fall of water to be 20 feet, the diameter of the wheels about 16 feet, and the speed of their skirts about 10 feet per second, worked by a head of 4 feet; from which he draws the deplorable conclusion, that "in all these establishments there is not obtained 50 per cent. of the power of the water used." But, a little simple arithmetic will furnish the proprietors of these mills with a more satisfactory account, and, perhaps, prevent their incurring the expense of a new arrangement, with a view to realizing the lost 50 per cent. of their power.

The velocity of the skirts of the wheels is 10 feet per second; this velocity is acquired by water in a descent of 18¾ inches.* But the water issues upon the wheels from under a head of 4 feet, under which its effluent velocity is 16 feet per second. Now, although the wheels are not much assisted by the impulsive power of the water, striking upon them with a velocity 6 feet greater than their own, yet they are certainly not retarded by it, and therefore, on no ground can we make the loss more than 4 feet; which is but one-fifth of the whole power or fall of 20 feet, leaving four-fifths as the proportion of the power effectively applied, instead of less than one half, as asserted in the article under consideration.

Our water works at Fair Mount, which so justly excite the pride of our citizens, and their gratitude to those public-spirited individuals to whose enterprise and skill we are indebted for them, come next in review; but as his information on some important points in this case, is incorrect, I need not enter into an examination of his conclusions; I will however, venture to offer my own views on the subject of the economy, and application, of the power consumed.

The head and fall, at high tide, is 6 feet 6 inches, the wheel, at this time, wading 2 feet in the tide; when the tide is out, it is 8 feet 6 inches, and as the tide rises and falls about 6 feet, twice in 25 hours, I suppose the wheels wade, more or less, for about 7 or 8 hours out of every 24; I will therefore, take the average head and fall, to be 8 feet.

The velocity of the skirts of the wheels is 12 feet per second, which is due to a fall of 27 inches. The water issues upon the wheel from under a head of 12 inches; its effluent velocity is, therefore, 8 feet per second; but, the direction given to it by the form of the aperture through which it issues, is at an angle of about 45 degrees with the breast of the wheel, of course, its velocity in the direction in which the skirt of the wheel moves, cannot be more than 5½ feet per second; but as the wheel moves at the rate of 12 feet per second, it must expend some of its power in impressing its own velocity on the water.[*] The whole loss of power may be estimated thus:—

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* See the table, p. 169.

The velocity of the wheel 12 feet per second, is acquired by water in falling, - - - - - - - - - 27 inches.

The water issues on the wheel from under a head of 12 in.

Its velocity in the required direction is 5½ feet per second, which is due to a fall of 5⅔ in.

The difference is so much lost, viz. 6⅓ inches.

Total loss 33⅓ inches.

Or thus:—

The velocity of the water in the required direction, is that which is due to a fall of 5⅔ inches.

Immediately on striking the wheel, it receives a velocity due to a fall of 27 inches.

The difference, indicates the power expended by the wheel, in giving it that velocity, - - - - - - 21⅓ inches.

The water comes on the wheel below the surface of the dam, - - - - - - - - - 12 inches.

Total loss as before, 33⅓ inches.

Thus it appears, that of the whole power expended, one third is lost by the excess of speed, and the manner in which the water is introduced into the buckets; and two thirds are effectually applied to the work.

The height through which the water is raised, from the dam to the reservoir, is 96 feet; the water which raises it, falls 8 feet; therefore, supposing that all the power could be effectually used, and no loss sustained on account of leakage, friction, &c. 12 gallons on the wheels descending 8 feet, should raise 1 gallon to the reservoir, 96 feet; whereas, every gallon that reaches the reservoir, costs an expenditure of between 30 and 40 gallons from the dam. Suppose the average expenditure to be 36 gallons, to raise 1 gallon; then, but one-third of this power is accounted for at the reservoir; and as I have shown that one-third is lost by the excessive velocity of the wheel, &c. the remaining one-third must be charged to friction, leakage, &c. This last third, however, is one half of the effective power.

I have made a calculation of the distances, and velocities, attained by falling bodies, in various fractional parts of a second, which is here introduced, for the information of those practical, and theoretical, engineers, who have avoided the labour of doing it for themselves.

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[*] Every visiter at Fair Mount must have noticed the noise produced by the percussion of the floats of the wheels, upon the water entering the buckets.

I have proceeded on the following established data, viz.

Heavy bodies fall through a distance of 16 feet, in the first second; at the end of which, they have acquired a velocity of 32 feet per second.—The velocity increases as the times.—The distance increases as the squares of the times.

Time of Descent.			Distance fallen. *ft.*	*inches.*		Velocity attained per sec. *ft.*	*inches.*
1	- -	-	0	$0\frac{1}{90}$	-	0	3
2	- -	-	0	$0\frac{1}{21}$	-	0	6
3	- -	-	0	$0\frac{2}{19}$	-	0	9
4	128ths of a sec.	-	0	$0\frac{3}{16}$	-	1	
5	- -	-	0	$0\frac{2}{7}$	-	1	3
6	- -	-	0	$0\frac{2}{5}$	-	1	6
7	- -	-	0	$0\frac{3}{5}$	-	1	9
2	- -	-	0	$0\frac{3}{4}$	-	2	
3	- -	-	0	$1\frac{2}{3}$	-	3	
4	32nds of a sec.	-	0	3	-	4	
5	- -	-	0	$4\frac{2}{3}$	-	5	
6	- -	-	0	$6\frac{3}{4}$	-	6	
7	- -	-	0	$9\frac{1}{4}$	-	7	
	1-4th of a sec.	-	1	0	-	8	
9	- -	-	1	$3\frac{1}{6}$	-	9	
10	- -	-	1	$6\frac{3}{4}$	-	10	
11	-	-	1	$10\frac{2}{3}$	-	11	
12	32nds. do.	-	2	3	-	12	
13	- -	-	2	$7\frac{2}{3}$	-	13	
14	- -	-	3	$0\frac{3}{4}$	-	14	
15	- -	-	3	$6\frac{2}{11}$	-	15	
	1 half of a sec.	-	4	0	-	16	
17	- -	-	4	$6\frac{1}{5}$	-	17	
18	- -	-	5	$0\frac{2}{3}$	-	18	
19	- -	-	5	$7\frac{2}{3}$	-	19	
20	32nds. do.	-	6	3	-	20	
21	- -	-	6	$10\frac{2}{3}$	-	21	
22	- -	-	7	$6\frac{3}{4}$	-	22	
23	- -	-	8	$3\frac{1}{5}$	-	23	
	3-4ths of a sec.	-	9	0	-	24	
25	- -	-	9	$9\frac{1}{5}$	-	25	
26	- -	-	10	$6\frac{3}{4}$	-	26	
27	- -	-	11	$4\frac{2}{3}$	-	27	
28	32nds. do.	-	12	3	-	28	
29	- -	-	13	$1\frac{2}{3}$	-	29	
30	- -	-	14	$0\frac{3}{4}$	-	30	
31	- -	-	15	$0\frac{1}{5}$	-	31	
1	- -	-	16	-	-	32	
2	seconds.	-	64	-	-	64	
15	- -	-	3600	-	-	480	
30	- -	-	14400	-	-	960	
	1 minute.	-	57600	-	-	1920	

To determine what *proportion* of a given water power, is lost by a given velocity of the wheel, it is only necessary to ascertain, what distance the water must descend to acquire that velocity. Then, this distance compared with the whole fall, answers the question. Thus: suppose the whole fall to be 10 feet, and the velocity of the wheel 4 feet per second; this velocity is due to a fall of 3 inches, or one-fortieth part of the whole fall, which is the proportion sought. Or, suppose the velocity to be 13 feet per second, which is due to a fall of 2 feet $7\frac{2}{3}$ inches, then the loss is rather more than one-fourth of the whole fall of 10 feet. But, it must be especially noted, that these estimates embrace the supposition, that the water issues upon the wheel in the direction of the motion of its skirt, and precisely at that distance below the surface of the dam, which answers to the velocity of the wheel. Inattention to this particular, is a very important, and frequent, cause of loss. L. M.

Animadversions on Mr. Genet's Reply to "Remarks on his Memorial on the Upward Forces of Fluids;" with additional observations on the merits of that work. By the EDITOR.—[*Continued from p.* 111.]

"Leave not a wreck behind."

In our last number we examined the high pretensions of Mr. Genet, to extensive information on the subject of the steam-engine, and will now ask the attention of our readers, to a few remarks upon his projected *improvements* in navigation and aerostation; and if we do not greatly mistake, we shall convince the phrenologists, that we have *the organ of destructiveness* completely developed.

We had been led to anticipate a very formidable reply to our strictures, published in January last; Dr. Pascalis having, some time since informed a mutual friend, that the proofs of our ignorance would be made to stand out in bold relief. The Doctor, we apprehended, would continue to sustain the character which he had assumed, as the champion of his friend, against those who are "not even qualified to bestow either praise or censure;" many of our remarks having been elicited by the bold tone of his communication in Dr. Silliman's Journal. Mr. Genet, however, informs us, that the task of defence devolves upon himself exclusively, from the determination of his friend "to observe only silence;" convinced, no doubt, that the better part of valour, is discretion. The cause of our being thus *sent to Coventry* by the Dr. is set forth by Mr. G., who, speaking of our remarks, says, "But how great was my surprise, at finding that nearly the whole of this new production of his pen, was in a great measure calculated to involve in my proscription, our worthy friend DOCTOR PASCALIS, SENIOR CENSOR OF THE STATE MEDICAL SOCIETY OF NEW YORK, AND PRESIDENT OF THE AMERICAN BRANCH OF THE LINNÆAN SOCIETY, and to hold us both up to public view, as fit subjects for ridicule; the one, for having advanced an untenable doctrine, and the other, for having in some measure countenanced it, by claiming for its author, on a subject entirely new, a suspension of censure and condemnation, until the whole scheme could be matured, and rectified, by actual experiment." We again protest against confounding the man and his projects; we have, ourselves, our moments of hallucination, and may therefore be in danger of suffering under a violation of this rule.

That the doctrines which one of these gentlemen has advanced, and which the other has boldly advocated, are fallacious, and ridiculous, it has been our object to prove; and in so doing, we have been labouring in our proper vocation. From the untenable nature of the premises assumed by them, the task has, necessarily, been an easy one; we, nevertheless, did expect something less puerile, and more imposing than the "Reply" before us. We shall not tax the patience of our readers, by noticing one half of the errors which it contains, but as we have entered the lists, we intend to make secure, the position which we have taken.

It will have been seen that Mr. Genet asserts, that his friend Dr. Pascalis has only "claimed for its author, [the memorial] on a subject entirely new, a suspension of censure, and condemnation, until the whole scheme could be matured, and rectified, by actual experiment." Let us, however, hear the claims, in the words of the Dr. himself, and learn if they are thus limited. In Vol. XI. p. 112, of Dr. Silliman's Journal, he says, "Mr. Genet undertakes to apply the aerostatic power to the raising, or lowering, of canal boats, on an inclined plane, between a water level, and a higher level, with or without water. He will propel boats on a high level, destitute of water, and lower them to a water level. He can raise or lower carriages on rail ways, from one level to another—relieve steam boats, stranded or grounded, &c. Combining also aerostatic and hydrostatic powers, he can raise or lower canal boats, to or from, a high vertical altitude; raise vessels stranded, and other heavy bodies, from under water, also on land, by means of hydrostatic cranes. He can direct how to prevent ships from sinking, &c. and finally, he will protect, or guard steam boats, against snags, sawyers, shoals and rocks."

And we, "can call spirits from the vasty deep," but then, they will not come when we do call them; and we apprehend, that, unless the voice of Mr. Genet be seconded by means more efficient than those presented in his memorial, he will find that matter, is, sometimes, as disobedient as spirit.

The basis upon which the assumptions of our author are built, is, that *there is a force in fluids, which urges them in a direction contrary to that of gravity;* and that in consequence of this *upward force*, and independently of the general laws of atmospheric pressure, the motion of a balloon, in ascending, is accelerated as the atmosphere grows lighter, and its pressure decreases: and that hitherto, this *Upward force*, or "*force of levity*," has been entirely overlooked, or neglected.—Caloric, or the matter of heat, is assumed to be this principle of levity; it is said, that it "gives levity to ponderosity, changes the laws of gravity, and denotes by its tendency to re-ascend to its centre of circulation, that gravity is not a positive, but a negative force, that it is not an active, but a passive agent." These are "the new natural powers, put in requisition," and for the application of which, Mr. Genet has obtained a PATENT.

We have looked, in vain, for a single fact, tending to prove the correctness of these assumptions; they stand therefore, in the same predicament with the assertion that, two and two make five; and it certainly would not be deemed wise to enter into an elaborate argument to disprove such an assertion, merely because some estimable, but wrong headed individual had made it. The "Preliminary principles, facts and authorities," (Memorial p. 12 to 22,) furnish no data whatever in support of the existence of his "New natural power," but contain, with the exception of many of those errors in philosophy, which are so thickly scattered over its pages, a number of admitted facts, and principles, relative to specific gravity; atmospheric pressure; pressure of water; aerostatics; mechanical powers, &c. It was in this part, if any where, that we ought to have been informed, why balloons, if made air tight, should not, after they have reached that point where they shake off their mundane coil, obey implicitly the principle of levity, by which they are elevated, "tending to re-ascend to its centre of circulation," the sun, and fly off to that luminary. Why the atmosphere itself, and all other gaseous bodies, should not rise from the surface of the earth, and, borne upward by their *specific levity*, seek the same centre of circulation; and why, if balloons rise because "Fire ascending seeks the sun," they will yet ascend at midnight, and consequently depart from their centre of attraction. Mr. Genet has repeatedly complained, that those who have opposed his views, have made assertions without offering proofs, but, excepting to one in his novitiate, it would be idle to attempt to offer proofs in support of principles generally received. It is Mr. Genet who has failed in this particular; he has boldly attempted to establish a new principle of specific levity; has denied the universality of gravitation; has declared that gravity is not an active, but a passive agent; and made many other assertions equally vague and fallacious, and seems to expect to sustain himself in so doing, by sounding titles, without advancing a single step in that rigorous course of experiment, or induction, which true philosophy demands.

Plate 1st, in the Memorial, and in the analysis published by Dr. Pascalis, is a representation of *an aerostatic elevator to raise and lower canal boats, on an inclined plane.* The force to be applied in the drawing up of canal boats, is the ascent of an air balloon, (*an aerostat,*) which is to act by means of a rope fastened to the bottom of it, and passing through a sheeve, or pulley, and thence up to the periphery of a large wheel, thirty feet in diameter. A pit is dug, at the bottom of which is the aforesaid pulley, the laboratory in which the hydrogen gas is to be prepared, &c. Over the whole, a building is to be erected, sufficiently extensive to contain the large wheel and its appendages; and sufficiently high to allow of the ascent of the *aerostat.* "In reference to the building and its dimensions, if an ascension of 90 feet, producing 900 feet distance, equivalent to 90 locks, was really wanted, the altitude from the bottom of the pit, to the top of the cupola, ought to be 96 feet, allowing six feet under, to attend to the balloon and gas." (Memorial, p. 29.) The balloon, according to the estimate made, if covered with *silk*, and forty-five feet in diameter, will possess an ascensive force of 3236 lbs., about *a ton and a half*; and a canal boat with its load, is estimated to weigh *sixty tons*.

Waiving all remarks upon the total ineligibility of the power proposed to be applied as the first mover, as there is little danger that any engineer, or mechanician, will make an essay of it, we will repeat the question which was originally asked by the Editors of the Boston Journal, "But why not use the descendent force of a leaden weight, as well as the ascensive force of an air balloon?" a question which it has not been convenient for Mr. Genet, or his friend, to answer. The balloon after it has ascended, is to be drawn down again; we beg pardon, "recalled down;" and, this naturally suggests the inquiry; how much less power will *recall* it down, than that which it exerted in its ascent? and why not use this power to draw up another boat, without troubling the balloon?

In calculating the power requisite to draw a boat of sixty tons, up a plane, with a rise of one foot in fifteen; Mr. Genet estimates it at 3200 lbs. Now we had understood, though, to be sure, it was according to the *exploded* philosophy, that in order to *sustain* a weight upon an inclined plane, the power so sustaining it, must bear the same proportion to the weight, which the perpendicular height of the plane, bears to its length; and that, consequently, in the contemplated plane, it must be equal to one fifteenth of the load of sixty tons, that is 8,000 lbs. instead of 3,200; a *trifling* difference, and easily obviated by enlarging the house, the balloon, and the laboratory, to considerably more than double their proposed capacity; but even then, the whole will be at rest, as we have yet to overcome friction, and to give motion; to effect which, another addition must be made to the power, which shall suffice to increase it to about four times the estimate.

When compared with some accompanying estimates, the foregoing exhibits but a slight deviation from correctness, as will appear upon examining the operation of the wheel thirty feet in diameter, and, in the round numbers of Mr. Genet, *ninety* feet in circumference. The rope, or chain, which is to draw up the boat, is to pass over a drum, or drums, of twenty feet in diameter, or *sixty* in circumference; the large wheel is to drive a pinion on the drum shaft, and give to the drums, fifteen revolutions, for one of the large wheel, so that the periphery of the drums will travel with ten times the velocity of the large wheel, or through 900 feet, whilst that of the large wheel travels 90, and of course, if the balloon be allowed to ascend 90 feet, it must draw the boat 900 feet. It is rather an inverted procedure in mechanics, to drive a pinion, by a wheel of fifteen times its size; but the object to be gained is very great indeed; no less than to cause a power of 3236 lbs. moving through a space of 90 feet, to raise 60 tons to the perpendicular height of sixty feet. According to the *exploded* philosophy, 80,000 lbs. or twenty-five times the amount assigned in the Memorial, would just balance the sixty tons. How mighty are the Upward forces!

For the mode of filling the aerostats, *instantly*, with the *coal gas*, Dr. Pascalis refers to the Memorial: anxious to learn how this was to be effected, we carefully examined the work, but alas, it was in vain.

"*To propel boats on a high level destitute of water, and to lower them to a water level,*" is the next scheme; it is the child of the former, and, resembling it in so many of its features, may be dismissed in a few words. There are to be rail-ways, with balloons and buildings, fixed as before, for raising the boats to a summit level; other balloons are to be placed, with similar appurtenances, at suitable distances from each other, and these, in their ascent, are to draw the boats along; after which, the balloons are to be successively "recalled down," that they may renew their labours.

"*To relieve steam boats stranded, or grounded.*" The boats are to be furnished with empty balloons, which are to be filled, *instantly* of course, with "ignited air," *cooled by passing it through water*, and with *coal* gas; which gases, we are told, are in general dissipated without any advantage. This ignorance of the very alphabet of chemistry, was not to be anticipated, from learned doctors, and philosophers of the present day. Coal gas in the chimney of a steam engine! This is a discovery of Mr. Genet's, of which, ignorant wights, his masters in chemistry and philosophy never dreamed; they might have looked there for carbonic acid, and nitrogen, and would have expected to find but little else; and with these they never would have thought of filling aerostats, excepting to promote the art of sinking.

Passing over various other projects for employing the same means, we come to the "*applications of the aerostatic and hydrostatic powers combined.*" Mr. Genet has, it seems, performed some experiments, by means of an instrument, which he calls an HYDROAEROSTATOMETRE; a hollow tin vessel filled with air, and of the capacity of half a cubic foot. By the use of this instrument, he professes to have ascertained, that, using the old French standard, of 70 lbs. to the cubic foot of water, the *upward force* of the instrument, when immersed in water, was 100 lbs. for every cubic foot. Although this is 30 per cent. more than could be obtained by any other philosopher, we may let it pass, as this difference will add but little to the efficiency of his machines.

The *hydroaerostatometre*, gives birth to the *hydrostat*, which, in principle, is the same with the *aerostat*, substituting copper for silk, atmospheric air for hydrogen, (or for carbonic acid, and nitrogen,) and water for atmospheric air. The *hydrostat*, is, in fact, a copper vessel filled with air, and is to be used "to *raise*, or LOWER, *vertically, canal boats, to a* HIGH ALTITUDE." (Memorial, p. 39.) This copper vessel, is, in the example given, to be a spherical balloon of fifteen feet in diameter, and it is said, will contain 15,000 feet of air, and allowing the 30 per cent. before given in, and reckoning nothing for the weight of the copper, the chain, &c. is to be pressed by the upward force of water, with a power of 150,000 lbs. or 75 tons. This copper ball is to be placed in a well into which water, when wanted, may be admitted. This well is to be 16 feet broad, and thirty feet deep; in it, the *hydrostat* is to be capable of rising to the height of *ten feet*, and by means of a rope or chain, like that of the *aerostat*, is to raise a canal boat, weighing seventy-five tons, to the height of *one hundred feet;* its power being increased ten fold, by causing a large wheel to turn a pinion $\frac{1}{10}$ of its diameter. To those who would be capable of understanding them, comment and reasoning are here unnecessary.

Several other applications of this *new* power are proposed, which we need not notice, as they are mere variations of that just given; we proceed therefore, to the *hydronaut*, in which it is to be used as a substitute for the steam engine. It will be seen from the remarks of Mr. Genet in his 'Reply,' that we had selected this as the principal object of notice, in our Journal, for January last. We will repeat a part of those observations, and add a few others on the same subject; but first, let us hear our author speak for himself. In his Memorial, after having noticed the reciprocating motion in the steam engine, he says, (p. 62.) "How can I procure the same alternate motion of the hydrostat? By immersing it alternately in two different fluids, air and water; but as a single hydrostat could not accomplish that object, and procure an alternate motion, rapid enough to perpetuate the rotatory motion, two must be employed; and by so doing, there will be no disparagement between the steam, and the hydrostatic engine; since it is well known that it has been found necessary to introduce two cylinders in the steam engine, to perfect the rotatory motion, and replenish the deficiency of a single cylinder."

Mr. Genet, as usual, errs when speaking of the steam engine, it being "well known" that, although two cylinders have been sometimes used, it has *not* been found necessary to introduce them "to perfect the rotatory motion, and replenish the deficiency of a single cylinder;" and that they have been abandoned, in nearly every instance, excepting in the loco-motive carriage. This gentleman is perpetually haunted by the ghost of the atmospheric engine, and must in his *numerous observations*, have mistaken the air pump, for a second steam cylinder.

We selected the hydronaut as the object of our former animadversions, because, of the whole series of proposed machines, we deemed it the most absurd. In the others, although totally inadequate to the production of the intended effects, there is a capacity for motion; but in this there is no principle of action, whatever; otherwise, it would be, to all intents, a *perpetual motion*, in the ordinary acceptation of that term. It is to operate without the application of any extrinsic force; no fuel is to be expended; no springs to uncoil; no weights to descend; no animal power, wind, or running water, to be used; nothing in fine but the principle of alternate, *absolute* *levity.* The thing is simply to be suspended in air, and water; is there to commence running, and to "navigate until it is stopped." When a man undertakes to construct a perpetual motion, and at the same time thinks himself a philosopher, we must leave *him* to himself; and if it be thought worth while to treat the subject with any degree of seriousness, it is only for the sake of the confessed tyro.

For the description of this apparatus, as given by Mr. Genet, we must refer to his Memorial, or to the analysis of it by Dr. P. and the accompanying plate in Dr. Silliman's Journal. We have described it, in the article already referred to, in our January number, and to save trouble, we here repeat our description.

"The *proposed* moving power of the hydronaut, consists of two hollow copper vessels, called *hydrostats;* they are to be cylindrical, with conical ends, perfectly closed; these are to be suspended upon a beam, twenty-four feet long, resembling that of a steam engine, and are to hang below it, similar to a pair of scales upon their beam. These hydrostats, are to be contained within two cylinders, which stand under the beam, and in which they may freely rise and fall, when the beam vibrates. These cylinders are to be open at top, and to have a valve in the bottom of them, to open a communication with the water in the river; by some means, (what means we cannot discover,) water is to be made to flow, alternately, in and out of these cylinders; that which contains water, will have the *hydrostat* immersed within it, forced up by its buoyancy, that at the opposite end, being allowed to descend, in consequence of the removal of the water; and so on, *ad infinitum.* The machinery by which it is intended to remove the water, is to be worked by the same beam. This machinery consists principally, of two pumps, oddly enough, called air pumps; their piston rods are attached to the beam, they being placed within the main cylinders; to the beam is also appended the apparatus for opening and shutting the valves; a piece fourteen feet in height, ascends from its centre, and from the end of this, a rod passes, which is to act upon a crank, and give motion to paddle wheels, whilst by the intervention of a *large wheel turning a pinion,* the velocity is to be increased. Should any one wish for a model of this machine, he may make it, by suspending an egg-shell upon each end of a small scale beam, these will be his *hydrostats;* then by taking two glasses of water, and passing them alternately upwards against the shells, he will cause the beam to vibrate; and if he can then only contrive to attach to the beam, something which will relieve his hands from the task of moving the glasses, he will have contrived a perpetual motion, exactly upon the principle of that of Mr. Genet. Should he be at a loss to see how this is to be done, we must refer him to the inventor, as we cannot direct him even with the aid of the engraving, and the book. 'So the *hydronaut* will navigate until it is stopped,' say the gentlemen concerned; we however, feel inclined to transpose the sentence, and to say, 'so the hydronaut will stop until it is navigated.'"

However ludicrous the machine may appear, as represented in the proposed model, Mr. Genet does not, and cannot deny, that, so far as it goes, the picture is a correct one; and that it would be completed by first allowing the tumblers to stand in a vessel containing water, so that this fluid might rise on the outside of them, to the same height at which it stood within, or to the same height at which it would stand, were their bottoms perforated; and then, if we can, causing the beam to work two pumps, and two valves, which shall alternately exhaust the tumblers of their water, and alternately allow them to fill; the beam must do this perpetually, until it be forcibly stopped; it must also produce a large excess of force, which, in the actual machine, is to give "power superior to the effective and disposable force of any steam boat navigating the ocean." Mr. G. further says, that between this and the steam engine "there is no difference but simplicity and economy."

Before proceeding to notice the grand project of a balloon, we will direct the attention of our readers, to a very interesting editorial paper on aerostation, which follows Mr. G.'s reply in the last number of Dr. Silliman's Journal; we have read this article with great pleasure, and coincide in opinion, with the learned author, in almost every point; we also concur with him in the spirit of his concluding remarks, but are far from thinking that the case in hand, is one to which they legitimately apply; he says, "We conclude by wishing Mr. Genet ample success. Failure will involve no disgrace, but success would add another brilliant leaf to the book of discovery." Although we doubt the practicability of steering balloons in the air, we have not the temerity to say that it is impossible, and we would cheerfully aid, and gladly witness, an experiment for the attainment of this object, provided the means indicated, were not, palpably, inadequate. But were some person to propose to elevate an aeronaut by the "specific levity" of carbonic acid; or to raise a load of seventy-five tons, to the height of one hundred feet, by the descent, or ascent, of a power of seventy-five tons, to the distance of 10 feet; we should feel ourselves disgraced in the eyes of every man of science, were we not to condemn the project in the most unqualified terms; and here also we undoubtedly agree, with Dr. Silliman.

"*The aerostatic vessel, or aeronaut,*" appears to be Mr. Genet's greatest favourite. We cannot attempt to point out the numerous fallacies respecting it, which are contained in the memorial, but will merely make a few remarks upon the main point, the proposed means of propulsion; and even on this, we shall offer but a small number of the objections which present themselves. Mr. Genet proposes to navigate his balloon by the power of two small horses, each equal to 100 lbs., making conjointly 200 lbs. In this estimate he has left out of view, that most important function of their power, velocity. His two small horses, would be able to draw the weight assigned, with a velocity of only two and a half miles per hour; yet with them he is to move sails, which, according to his own calculation, are to "produce a pressure of 4200 lbs. *per minute* upon the air." Now according to the vulgar arithmetic, by which other philosophers have made their estimates, this would exceed the power of these horses 20 fold; but Mr. Genet says, that their power "being multiplied by 21 revolutions of the air wheels in one minute, will produce a pressure of 4200 lbs.” The same principle prevails here, as in his other machines; power and speed, are both to be obtained, by making large wheels act upon small ones.

The small power which we have assigned, say $\frac{1}{20}$ of that claimed, will be reduced to less than nothing, by making a very moderate allowance for friction, and by the want of propelling power in the paddle wheels, a main feature in the apparatus. These wheels, which are estimated to act upon the air with a force of 4200 lbs. per minute, are each to be furnished with sixteen wings, or fins, five feet in length, and two and a half in width. Eight of these on each side, are to act at once, the other eight being doubled up, within a case, or curb, to prevent their neutralizing those which are in action. Allowing it to be practicable to fold in these wings, without an immense loss of power, let those of our readers who possess either the Memorial, or the Journal, turn to the plate, and see what will be the action of the eight which remain; that is, what portion of their power will be employed in urging the balloon forward. It will be at once perceived that the wings which are first liberated, tend to drive the aeronaut back, just as much as those below, tend to drive it forward, and that the only apparent effect, would be to elevate it, by the descent of those which are intermediate. We are a little surprised that this case, or curb, was not placed upon the top; this certainly would have been an improvement, at least, as regards the apparent power of propulsion, for although the thing would still have been nearly powerless, it would have looked as though it might possess power.

Before closing, we will offer another mode of estimating the power of the horses, founded upon data, given by Mr. Genet. A section of the aeronaut, the car, the wheels, &c. would measure about 2500 square feet. A brisk breeze, according to a table given in the Memorial, travels at the rate of about eleven miles per hour, and exerts a force of about eight ounces upon every square foot, this upon 2500 feet, would be 1250 lbs.; and this therefore is the force, which when a brisk breeze blows, tends to carry the balloon, eleven miles per hour. This is equal to the power of about 60 of Mr. Genet's horses; and were it not for the intervention of his *wheels and pinions*, it would be necessary to employ, at least, this number, notwithstanding the bird-like form of his balloon.

But after all, may not the aeronaut burst? The probability of this is confessed; but although, without freight, passengers, or *additional horses*, the articles taken up are estimated to weigh 13,400 lbs. Mr. Genet assures us that “the downfall would be as light as a feather,” as he is confident that the whole would form an immense parachute. Should he err as widely in this estimate, as in those which have preceded it, the consequences might be very serious; and for ourselves we aver that we will not, if invited, consent to ascend, unless one of the horses be assigned to us, and he be of the Hypogryf breed.

Account of a new Scheme of Perpetual Motion, invented by SIR WILLIAM CONGREVE, *Baronet.* With remarks by the EDITOR.

WE apprehend that our readers will conclude that we have said enough respecting the upward forces of fluids; still we are tempted to present this subject in a new form, and must again urge the apology, that although we think the scheme, about to be presented, worthless, it derives some claim to notice, from the standing of the individual who is its author. Sir William Congreve is a member of the British Parliament, and claims to be a man of science, and an engineer. He is the inventor of the rockets which bear his name; and which during the late war, were much more effectual in alarming our women and children, than in injuring our forts, or soldiers. He was also the contriver of a clock, which was intended to look like a perpetual motion. We saw one of them in Raleigh, some three or four years since: it was a pretty looking toy, but worse than useless, as it kept a ball in motion, which served only to injure the going of the clock. We might enumerate several other abortive schemes, which have given celebrity to his name, but will notice only one other before explaining his last project. He was the most active opponent of our countrymen Perkins and Fairman, in their mission to England, for the purpose of introducing their plan for preventing the counterfeiting of bank notes. In this opposition he succeeded, so far as to prevent their employment by the bank, and to secure to himself the business of the stamp office: this latter has, however, been recently taken from him, and given to Perkins and Heath, as may be seen by the letter of the former gentleman, published in our June number. This letter contained some details upon this subject, which we thought it best to omit, in laying it before the public.

We have been induced to make the foregoing remarks as a necessary preface to the account of the perpetual motion, for which we understand Sir William has obtained a patent; and which, we apprehend, is that announced in the list of English patents, p. 69. "To Sir William Congreve, Baronet, for his having invented a new motive power, 8th February." This, we have no doubt, will add another to the list of this gentleman's abortive labours, and to the catalogue of those persons whose grasp the phantom, perpetual motion, has eluded, at the moment in which they have thought it secured; still there is a considerable display of ingenuity in some of his proposed arrangements, and, it is to be regretted, that this ingenuity has not been directed to some purpose of practical utility.

The drawings which we have given, will fully explain the manner in which the power is expected to be obtained. It is necessary, however, to premise, that in the wheels represented in figs. 4 and 5, which are to be surrounded by a band of sponge, there is to be an apparatus to squeeze the water out from one side of this band, whilst on the opposite side it rises by capillary attraction.

The first part of the following account is from a report on this subject, published in the *Atlas;* and the remainder, from a pamphlet issued by the Baronet.

"The celebrated Boyle entertained an idea that perpetual motion might be obtained by means of capillary attraction; and indeed there seems but little doubt that nature has employed this force, in many instances, to produce this effect.

"There are many situations in which there is every reason to believe that the sources of springs on the tops and sides of mountains depend on the accumulation of water created at certain elevations by the operation of capillary attraction, acting in large masses of porous material, or through laminated substances. These masses being saturated, in process of time become the sources of springs and the heads of rivers; and thus, by an endless round of ascending and descending waters, form, on the great scale of nature, an incessant cause of perpetual motion, in the purest acceptation of the term, and precisely on the principle that was contemplated by Boyle. It is probable, however, that any imitation of this process, on the limited scale practicable by human art, would not be of sufficient magnitude to be effective. Nature, by the immensity of her operations, is able to allow for a slowness of process which would baffle the attempts of man in any direct and simple imitation of her works. Working, therefore, upon the same causes, he finds himself obliged to take a more complicated mode to produce the same effect.

"To amuse the hours of a long confinement from illness, Sir William Congreve, has recently contrived a scheme of perpetual motion, founded on this principle of capillary attraction, which, it is apprehended, will not be subject to the general refutation, applicable to those plans in which the power is supposed to be derived from gravity only. Sir William's perpetual motion is as follows:

"Let A, B, C, Plate III, fig. 3, be three horizontal rollers fixed in a frame; *a*, *a*, *a*, is an endless band of sponge, running round these rollers, and *b*, *b*, *b*, an endless chain of weights surrounding the band of sponge, and attached to it; so that they must move together.

"Every part of this band and chain being so accurately uniform in weight that the perpendicular side A, B, will, in all positions of the band and chain, be in equilibrium with the hypothenuse, A, C, on the principle of the inclined plane. Now, if the frame in which these rollers are fixed, be placed in a cistern of water, having its lower part immersed therein, so that the water's edge cuts the upper part of the rollers B, C; then, if the weight and quantity of the endless chain be duly proportioned to the thickness and breadth of the band of sponge, the band and chain will, on the water in the cistern being brought to the proper level, begin to move round the rollers, in the direction A, B, by the force of capillary attraction, and will continue so to move. The rationale is as follows:

"On the side A, B, of the triangle, the weights *b*, *b*, *b*, hanging perpendicularly alongside the band of sponge, the band is not compressed by them, and its pores being left open, the water at the point x, at which the sponge meets its surface, will rise to a certain height y, above its level; and thereby create a load, which load will not exist on the ascending side C, A, because on this side, the chain of weights compresses the band at the water's edge, and squeezes out any water that may have previously accumulated in it; so that the band rises in a dry state, the weight of the chain having been so proportioned to the breadth and thickness of the band, as to be sufficient to produce this effect. The load, therefore, on the descending side, A, B, not being opposed by any similar load on the ascending side, and the equilibrium of the other parts not being disturbed by the alternate expansion and compression of the sponge, the band will begin to move in the direction A, B, and as it moves downwards, the accumulation of water will continue to rise, and thereby carry on a constant motion, provided the load at *x*, *y*, be sufficient to overcome the friction on the rollers, B, A, C.

"Now, to ascertain the quantity of this load, in any particular machine, it must be stated, that it is found by experiment that the water will rise in a fine sponge about an inch above its level; if, therefore, the band and sponge be one foot thick, and six feet broad, the area of its horizontal section in contact with the water would be 864 square inches, and the weight of the accumulation of water raised by the capillary attraction, being one inch rise upon 864 square inches, would be 30 lbs., which, it is conceived, would be much more than equivalent to the friction of the rollers."

"The power of a wheel thus set in motion, may either be applied in the common mode, or by machinery at the end of the axis; or the wheel itself, as in fig. 4, may be made to revolve in a circular cistern of water, of any convenient diameter, being connected by an arm from the centre of the wheel to an upright revolving shaft in the centre of the cistern, so as to be connected with machinery, and produce a similar effect to that obtained by a horse mill.

"It is evident that a constant accumulation of weight on one side of such a wheel as here described, and not on the other, would cause it to roll forward spontaneously in the circular path thus marked out for it; and as this progressive motion must necessarily occasion a considerable undulation in the water contained in the cistern, this undulation will raise the water in front of the wheel some inches above the level of the accumulation caused by the mere capillary attraction. If, therefore, this rise of the waves thus created be four inches above the water's level, the accumulation of water in the sponge on the descending side, including the one inch gained by the capillary attraction, would be five inches in height, and by this means the motive power of a wheel, the original power of which would be 30 lbs., as calculated above, would thus be raised to 150 lbs., which might probably be still further augmented by some mechanical means placed in front of the wheel to increase the agitation of the water.

"Thus if a ripple so created, rose about nine inches, including the capillary ascent, and were repeated every second, the periphery of the wheel would move through a space of nine inches in that period, and revolve at the rate of forty-five feet per minute, with a constant descending weight of rather more than 180 lbs.; which would make the power of such a wheel rather above the power of one man; and if five such wheels were combined, so as to work round one centre, their united force would be equal to that of a one-horse power steam engine.

"This mode of increasing the power of the revolving wheel in the above figure, by exciting an undulation in the water in which the wheel floats, leads to an application of a similar principle, by which the force of the waves of the sea may be applied with great effect as a moving power to ships and boats, which I shall here, therefore, explain:

"Figure 5, represents the bow of a boat having a wheel of suitable dimensions fixed in front of its stem, by a strong frame work. This wheel is a hollow cylinder closed at the ends, but open all round, with its interior divided into compartments, similar to the Persian wheel, and so disposed that, on a wave rising to any height on the periphery of this circle, all that part of the wave which enters the interior of the wheel or cylinder, shall be retained in the fore-part thereof; while any part of this water, which shall find its way into the after-part of the wheel shall not be retained, but flow out again immediately; so that in case of a wave rising to the full height of the wheel, the whole of the front half of the cylinder shall be fully charged with water, while there would be no counterbalancing quantity in the after-part. The consequence of this, therefore, would be, that a constant revolving force would be kept up by a succession of waves; this force being in proportion to the breadth and diameter of the wheel, and to the height of the wave. Thus, if a wheel be six feet in diameter, and six feet broad, and the perpendicular rise of the waves be also six feet, the maximum charge or moving power of such a wheel would be about 1½ ton, being the weight of water contained in the front half of the wheel, and this, supposing the ship to be in motion, would probably be renewed by succeeding waves, about 20 times per minute. On an average, however, the perpendicular rise of a wave at sea, in lakes, or large rivers, could not perhaps be taken at more than from four to five feet, but this would be somewhat increased by the pitching of the vessel; the revolving power, therefore, of such a wheel, might on an average be estimated at one ton, acting by repeated impulses, similar to that of the common oar or paddle; and supposing the least wave that could be reckoned upon to be from one to two feet in height, so the least probable power, in calm weather, might be taken at 5 cwt.

"The velocity with which the charge of water will descend in these different cases, would, of course, vary. Thus in the first instance, where the wheel has its full charge, the centre of gravity of this water, will be found rather above the horizontal radius, so that every charge would fall through a space of about five feet before it would discharge itself; and supposing therefore, the succession of waves were about 20 in a minute, the moving force of this wheel might be taken at 1½ ton 5-|-feet-|-20, that is to say, 1½ ton moving through 700 feet in one minute; which will be found to be about equal to the power of a ten horse steam engine. In the second case allowing for a proportionate falling off in the succession of waves, and in the velocity of the descent of the water—the power exerted may be considered as equivalent to the power of a six horse engine, and in the latter case, to that of a two horse power. A similar wheel also might be placed at the stern of the vessel with equal effect; and two or three such wheels might be applied without inconvenience on either side, being mere external appendages, by which means the first power of an enormous propelling force might be attached to a vessel without any internal apparatus, labour, or fuel whatever.

"In larger vessels, it is evident that a wheel of ten or twelve feet in diameter may be used instead of six feet, by which a proportionate increase of power would be gained. Thus the maximum power of a wheel twelve feet in diameter, and six feet wide, would be equal to that of an 80 horse power engine, supposing it to be charged by a repetition of waves at twenty feet per minute, and supposing the centre of gravity of each successive charge to pass through a space of 10 feet before it emptied itself. Two such wheels, therefore, would propel a very large vessel without the slightest loss of stowage, or any expense, beyond the first cost. When moderate velocities only are required, the propelling power may be obtained direct from these wheels by furnishing them with paddles similar to the propelling wheels of a steam boat; but where greater velocities are required, these cylinders should not themselves be furnished with paddles, but should be used merely to drive propelling wheels connected with them by machinery, so as to move at double or treble the rate of these first movers themselves.

"It may be objected to this mode of propelling vessels, that the necessary undulation on the surface of rivers and seas is not always to be found. To this objection, however, it may be most conclusively answered, that in this respect the system of propelling by the rise and fall of waves, is even more general in its application than the present system of propelling ships by the wind; for whenever there is wind there must be waves, and considerable waves are frequently to be met with, even in a dead calm, which is so far a gain in favour of the new system. But there is a still more important circumstance in favour of the new system, which is, that in the latter case, the force is alike applicable to all points of the compass, whereas, the power of sails can only be applied in about twenty points out of thirty-two, in which respect it obtains all the superiority of steam navigation, without its expense or inconvenience. To this also may be added it is much less liable to accident and danger from bad weather, than the system of navigation by sails."

Although we do not believe that a sufficient power can be obtained by the means above indicated, even to overcome the friction of the rollers, and, of course, view all the foregoing calculations as extravagant in the extreme; yet, we do not see that absurdity in the proposition, which characterizes all the projects for obtaining a perpetual motion upon the principles of gravitation; nor indeed does the proposition of the Baronet, include the idea of a perpetual motion, as this term is restricted by those who have written upon the subject. This has been defined to be, *a motion which is supplied, and renewed from* *itself, without the intervention of any external cause.* It is probable that, independently of those motions to which the whole mass of the earth is subjected, all the particles of the individual bodies which compose it, are in a state of relative motion; chemical decomposition, and combination; and contraction, and expansion, from a constantly varying temperature, seem fully sufficient to justify this conclusion. We can readily apply this change of length in a metallic rod, to keep a time piece perpetually wound up, and thus preserve it in action until stopped by the wear of the materials; but still this would not be what is intended by a perpetual motion. Galvanism, variations of temperature, the motion of air, or of water, and every other agent extrinsic to the machine, is, therefore excluded.

The impossibility of constructing such a machine, has been repeatedly demonstrated; as, to effect it, would require us to discover a body, which, in one position, possesses less gravitating force than in another; or in other words, which is both heavier and lighter than itself. It is not our intention to discuss this subject, at present, although it is probable, we may take occasion to do so hereafter, as it is one which has claimed the attention, and consumed the time, of many ingenious, and of some very intelligent men.

ENGLISH PATENTS.

To James Yandal, *of Cross Street, in the District of St. John's, Waterloo Road, in the County of Surrey, private person, for his Discovery of an Improvement, or Improvements, on Apparatus for Cooling and Heating Fluids.*

This is an apparatus designed for cooling worts and other hot fluids, without exposing them to evaporation. Utensils employed for this purpose, are generally called refrigerators, and are so constructed, that a quantity of cold water shall be brought in contact with the vessel which contains the heated fluid. But in every construction of refrigerators heretofore used, the quantity of cold water necessarily employed in the operation, greatly exceeded the quantity of the fluid cooled, which, in some situations where water cannot be readily obtained, is a serious impediment and objection to the use of such apparatus.

The inventor has contrived a mode of constructing a refrigerator, so that any quantity of wort, or other hot fluid, may be cooled by an equal quantity of cold water; the process being performed with great expedition, simply by passing the two fluids through very narrow passages, in opposite directions, the result of which is, that the cold liquor imbibes the heat from the wort, or other hot fluid, and the temperature of the hot fluid is reduced in the same ratio.

The patentee commences his specification by saying, "Previously to describing my improved apparatus, I think it right to make a few observations on my discovery, and the general nature or principles upon which my apparatus is constructed. If two fluids of different temperatures be brought nearly together, separated only by a thin metallic partition, and the surfaces of the two fluids be greatly extended, or thinly spread, compared to their quantity or volume, a rapid interchange of temperature will take place, (assimulated to mixing,) and each of them will acquire the medium temperature in a very short space of time. Now if the two fluids be made to pass each other in opposite directions, through a vessel or apparatus having contiguous passages, so that the temperatures of the liquors may act upon each other, separated by a thin metallic surface, greatly extended, compared to the quantity or volume of the liquor; or in other words, so that two thin sheets or lamina, (as they may be called,) one of hot fluid, the other of cold, be made to act upon each other's temperature, passing in opposite directions, and the thickness of such sheets or lamina of fluid, do not exceed half an inch, and may be as thin as one sixteenth of an inch, the interchange of temperature will rapidly take place, and with nearly the same effect as if they were mixed together; and, if these contiguous passages be of sufficient length, I find, that the hot fluid entering its passage at one end of the apparatus, and the cold fluid entering its passage at the reverse end of the apparatus, there will be very nearly a complete transfusion of heat; and by actual experiment I have found, that wort, or other heated fluid, entering my apparatus at a temperature above 200° Fahr. will pass out at a temperature of 60° Fahr. while the water entering at 56°, will come out at a temperature above 190°; a little heat being necessarily lost by radiation, or the exchange of temperature would be more complete. Having made these general explanatory observations, I proceed to describe my apparatus."

Plate III. fig. 1, represents one form of this apparatus, in this the channels, or passages, run in a zigzag direction; sometimes, when the instrument is made in this form, its position is altered, one of the flat surfaces which form the ends, in the drawing, being placed upon the stand, the other, of course, becomes the top; the plates are sometimes bent spirally, so as to form a convoluted curve. These channels, or passages, are of very small capacity in thickness, but of great length, and of any breadth that may be required according to the quantity of fluid intended, to be cooled or heated.

Fig. 2, is the section of a portion of the apparatus, upon an enlarged scale; it is made by connecting three sheets of copper or any other thin metallic plates together, leaving parallel spaces between each plate, for the passage of the fluids, represented by the black lines.

These spaces are formed by occasionally introducing between the plates, thin straps, ribs, or portions of metal, by which means very thin channels are produced, and through these channels the fluids are intended to be passed, the cold liquor running in one direction, the hot, in the reverse direction.

Supposing that the passages for the fluids are each one eighth of an inch thick, then the entire length for the run of the fluid, should be about eighty feet, the breadth of the apparatus being made according to the quantity of fluid intended to be passed through it in a given time. If the channels are made a quarter of an inch thick, then their length should be extended to a hundred and sixty feet; and any other dimensions in similar proportions: but a larger channel than one quarter of an inch, the patentee considers would be objectionable. It is however to be observed, that the length here recommended is under the consideration that the fluids are driven through the apparatus by some degree of hydrostatic pressure from a head in the delivery vats above; but if the fluids flow without pressure, then the lengths of the passages need not be quite so much extended.

In the apparatus constructed as shown in perspective, at fig. 1, and further developed by the section fig. 2, cold water is to be introduced at the funnel *a*, whence it passes down the pipe *b*, and through a long slit or opening, in the side of the pipe, into the passage *c*, *c*, (see fig. 2,) between the plates, where it flows in a horizontal direction through the channel, towards the discharge pipe *d*. When such a quantity of cold water has passed through the funnel *a*, as shall have filled the channel *c*, *c*, up to the level of the top of the apparatus, the cock *e*, being shut, then the hot wort, or other liquor, intended to be cooled, may be introduced at the funnel *f*, and which, descending in the pipe *g*, passes in a similar manner to the former, through a long slit or opening, in the side of the pipe *g*, into the extended passage *h*, *h*, (see fig. 2,) and from thence proceeds horizontally into the discharge pipe *i*.

The two cocks *e*, and *k*, being now opened, the wort, or other liquor is drawn off, or otherwise conducted away through the cock *k*, and the water through *e*. If the apertures of the two cocks *e*, and *k*, are equal, and the channels equal also, it follows, that the same quantity of wort, &c. will flow through the channel *h*, *h*, *h*, in a given time, as of water through the channel *c*, *c*, and by the hot fluid passing through the apertures in contact with the side of the channel which contains the cold fluid, and in a contrary direction to that of the cold fluid, the heat becomes abstracted from the former, and communicated to the latter, and as the hot fluid enters the apparatus at that part which is in immediate contact with the part where the cooling fluid is discharged, and the cold fluid enters the apparatus at that part where the wort is discharged; the consequence is, that the wort, or other hot liquor, becomes cooled down towards its exit pipe, nearly to the temperature of cold water; and the temperature of the water at the reverse end of the apparatus, becomes raised nearly to that of the boiling wort.

It only remains to observe, that by partially closing either of the exit cocks, the quantity of heat abstracted from one fluid, and communicated to the other, may be regulated; for instance, if the cock *e*, of the water passage be partially closed, so as to diminish the quantity of cold water passed through the apparatus, the wort or other hot fluid conducted through the other passages, will be discharged at a higher temperature; which in some cases will be desirable, when the refrigerated liquor is to be fermented.

The apparatus constructed upon any of the proposed plans, is calculated to be adapted with great advantage in place of the ordinary worm of a still, its power of cooling, and condensing the vapour, greatly exceeding any other description of refrigerator, and at a much smaller expense of cold water or other cooling fluids, as in this case the wash prepared for distillation, may be passed through the apparatus in place of cold water, and by extracting the heat from the distilled vapour, in the adjoining channel, (which must here be closed,) will condense the spirit therein, and have its own temperature raised at the same time, almost to the boiling point. Under these circumstances, the apparatus will be both a califier, and a refrigerator, and be the means of effecting a great saving of fuel in the process of distillation.

This apparatus must be considered as a great improvement upon the refrigerating worm heretofore used; in consequence of its exposing a surface so much more extended, and by the employment of a stream of cold liquor running in opposition to the course of the condensed fluid, the temperature never varies, the termination of the cooling process being as perfect as the commencement.

When this apparatus is adapted to a steam engine, it causes a very rapid condensation of the steam, by a small expenditure of water, and thereby will in a great degree, dispense with the necessity of the air-pump, (which is a minus power exerted against the engine,) or at least it will so much assist the operation, that a comparatively small air-pump, will be required, and the water heated in passing through the apparatus, may be immediately conducted into the boiler, at a boiling temperature, or nearly so.

The patentee says, " It will be unnecessary to point out all the situations or circumstances in which this apparatus for heating and cooling fluids may be applied, as I have already explained generally its extensive employment in several branches of the arts, and the manner of constructing it, as well as the proportionate dimensions being set out, it only remains to say, that those dimensions are to be enlarged in due proportion, in constructing an apparatus of greater magnitude than those above described; but I wish to observe, that I do not approve, in any case, of making the channels more than half an inch in width."—Enrolled February, 1827.

[*Newton's Journal.*

We inserted a notice of this invention in p. 69, vol. 3, under the head of *Yandal's Califier, and Refrigerator.* We think the account of its excellence there given, is fully justified by the foregoing description, which is much more than can generally be said in similar cases. The succeeding patent is for a modification of the same means; and there is also an existing patent in this country, founded upon similar principles; the specification we have not seen, nor do we know the date of the grant, upon which its validity must, of course, depend.—Editor.

To DOMINIQUE PIERRE DEURBROUCQ, *of Leicester square, Middlesex, Esq. for an apparatus adapted to cool Wort, or Must, previous to its being set to undergo the process of fermentation; and also for the purpose of condensing the steam arising from stills during the process of distillation; communicated by a Foreigner.* Dated May 23, 1826.

IN the apparatus described in the specification of this patent, the smallest of three tubes, of successively decreasing dimensions, is enclosed concentrically within that of the medium size, that, in its turn, is enclosed in the same manner within the largest; which latter, according to the scale of the drawing, is four inches in diameter, and about seven feet long. The middle tube, formed of thin copper, is fluted longitudinally, like the shaft of a column, (or, more precisely, is moulded so as to assume that shape,) and its external projections lie within a circle, which is only half an inch less across than the external tube; while the circle of its internal projections exceeds the internal tube by two inches in its diameter; it is made in joints about three feet in length, in which the flutes do not extend the whole length, but are so managed as to leave a plain rim two inches broad at each end, somewhat less in diameter than the fluted part, and by these plain bands the joints are united together by solder with an overlap of half an inch, so that there will be a plain cylindrical band, three inches broad, interposed between each fluted part, when they are all connected to each other. The internal tube ends in a conical point at each extremity; and the fluted tube is terminated in the same manner; but the external tube exceeds the others in length, so as to leave an enlarged part beyond them at each end, whose shape is not material.

These tubes thus combined, are placed in a position a little declining from the horizontal, at the extremity from whence the liquor is discharged; and beneath them a trough is fixed to catch the water, which is let to flow on the outside one, as will presently be explained; while the whole is supported either by a wooden stand, or by brick work, as is found to be most convenient.

It will be observed that the three tubes, from their above mentioned arrangement, will leave between them all round two concentrical longitudinal cavities; the first bounded by the external tube, and the fluted tube, and the second by the latter and the internal tube. Into the highest end of the first cavity the wort, or must, is let to run by a pipe from the vessel in which it is contained, and is discharged at the other extremity by another pipe, which conveys it to the guile tub, both of which pipes are furnished with cocks, by turning which the flow of the liquor may be made as slow as may be desired for the temperature at which it is to be delivered, which is regulated by a thermometer; a third pipe ascends vertically from this cavity, as high as the level of the top of the vessel, from whence the liquor runs, which serves as a safety pipe, to prevent injurious strains on the enclosing tubes from any accident.

Through the second cavity (between the internal tube and the fluted tube) cold water is conveyed from a reservoir by a pipe that enters its lowest end, while another pipe at its other extremity discharges it away from the apparatus; both these pipes have cocks, by which the water may be made to pass more or less slowly, as will best promote the cooling of the wort, or must. From this second cavity a pipe rises to the level of the top of the water reservoir, to discharge the air from it, when the water is permitted to enter. Also from the hollow vacant space of the internal tube an air pipe ascends through the other two tubes at its upper end, and another pipe passes downwards through them at its other extremity, to permit any water to drain from it, which might casually leak into it from the cavity by which it is surrounded.

The part of the apparatus described is principally employed in cooling the internal surfaces with which the wort comes in contact, or the fluted tube; but it is also expedient to cool the external boundary of the cavity in which it is contained, or the external tube; which is effected by covering it with linen or cloth, kept constantly wet by water, let to flow slowly on it from numerous small pipes, proceeding from the sides of a horizontal pipe of larger dimensions, placed directly above it and parallel to it, which branches off from the cold water pipe that runs from the reservoir to the second cavity; and which after passing over the external tube, turns down into the end of the pipe, through which the wort enters the first cavity, where it is closed by a cock, as are also all the little pipes that branch off from it; the use of which latter cocks, are to make the quantity of water which falls through them on the covering of the external tube, such as will produce the greatest effect, without waste; while the other larger cock, at the end of the supply pipe just mentioned, serves to admit water into the first cavity, when it is required to be cleaned from the substances contained in the wort, which might adhere to its internal surface; to assist which operation, another pipe runs down from it at the farther end, to let the water run off, which, when not thus employed, is kept closed by a cock; but when this cavity is to be thus rinsed, the cock of the pipe that admits the wort into it is to be closed, and the wort which it may contain, is to be let to run off entirely through the pipe at the other end, whose cock is then to be closed, as are also all the small cocks of the branch pipes; after which, on the cock of the supply-pipe and that of the drain-pipe also, at its opposite end, being opened, the water will run through faster or slower, as these cocks are more or less opened, according as will best promote the cleansing of the cavity.

After what has been just stated, the use of the trough underneath the external tube, before mentioned, in catching the water that drops from its cloth covering, will be sufficiently obvious, without farther explanation, and we have now only to add, that a pipe descends from its bottom at one end, to convey this waste water into a drain.

The external tube is made in joints, with flaunches fastened together by screws, in such a manner, that some of the joints may slip over the others, when required; and the pipes that pass through have screw joints, that permit them to be separated from it without disturbing the rest of the apparatus; by which means all parts of it, successively, may be removed from over the fluted tube, to permit the interstices of this latter to be completely cleansed, when the former method of letting water run through it has not been found to be sufficiently effectual.

The three concentric tubes are to be made somewhat smaller at the lower end, where the cold water enters, which the patentee thinks will cause the latter to have more effect in cooling the wort. Hoops are also directed to be put at the inside of the internal tube at regular intervals asunder, to strengthen it, and notches are made at the bottom of their lowest sides, to let the water pass, that may enter from leakage.

The whole apparatus may be applied for the purpose of condensing the products of distillation, as well as for cooling wort, without any material alteration, by merely uniting a pipe from the still head to that, through which the wort has been mentioned to enter.

The dimensions of the parts of the apparatus, though laid down from a scale in the drawing belonging to the specification, may be varied considerably, without producing any material defect, provided they are not too small for the work, which they are intended to perform; and those of them, which the patentee particularly claims, are the fluted internal tube, and the cloth covering of the external tube, kept constantly wet in the manner which has been explained.

An ingenious mode of distillation by the external application of a gentle stream of water to the still head, has long been in use in East India, of which we first had an account here, from a paper published by Archibald Keir, Esq. in the Transactions of the Asiatic Society, a short time previous to the year 1793, on the method of distillation used at Chatra, in the province of Ramgur.

In the voyage towards the North Pole, made by Captain Phipps, in 1773, a somewhat similar mode was practised in distilling fresh water from that of the sea, by merely keeping the pipe cool, which ran from the still head, by *swabbing* it with a wet mop.

We have always thought, that the principle of condensation, used in those simple methods, deserved farther experiment and improvement, and are happy to perceive that the patentee has endeavoured to attain this desirable object.

Of the apparatus described, we shall only observe that the internal tube seems to us entirely superfluous, being quite vacant of any thing but air; and that, if it were omitted altogether, the larger body of water, which would then be in contact with the inside of the fluted tube, supposing its dimensions remained the same as first directed, would be rather serviceable; particularly as the heat from the inclosed wort would not be prevented from traversing the water sideways, and rising to the top of the fluted tube by the internal tube, as the patentee seems to imagine. [*Rep. Patent Inven.*

AMERICAN PATENT.

To Warren P. Wing, *of Massachusetts, Manufacturer, for an improved Steam engine.* August, 1827.

To all to whom these presents shall come, be it known that I, Warren P. Wing, a citizen of the United States of America, have invented a new and useful improvement in the steam engine, by which it is rendered more simple and compact than heretofore, and in which, the fuel is used with great economy. For which invention and improvement, I claim a patent according to the laws of the United States.

And I the said Warren P. Wing, do hereby declare that the nature of my said invention and improvement, and the manner in which the same may be carried into effect, are fully made known, in the following description, and specification.

The dimensions of my improved engine may vary according to the power which may be required, and its form may be varied according to the taste, or wishes of those who use it. For the sake of facility of description, I will give the dimensions of one which I have made, and which after a fair trial, has been found to answer well in practice.

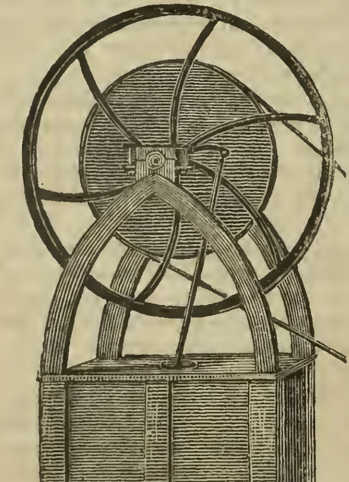
The furnace is of cast-iron, it is two feet nine inches long, one foot four inches wide, and two feet two inches high; and its appearance resembles the common stove used for warming apartments; it may be made of sheet-iron, or built entirely of brick: when made of metal, it should be lined with fire clay, or bricks. Within this furnace is placed the generator, which consists of a tube of metal, joined by flanches, or otherwise, so as to extend from twenty to forty feet in length, making several revolutions within the furnace, in the manner of the worm of a still; this tube in the engine described, has an internal diameter of about three quarters of an inch, and is made sufficiently thick to sustain the pressure of highly elastic steam.

The cylinder is about three inches in diameter, with a stroke of about eleven inches; this stands upon the furnace, the centre of the upper plate of which is perforated, so as to admit the lower end of the cylinder, to come in contact with the fire, to sustain the heat of the steam. This cylinder is open at top and closed at bottom, in the manner of the old atmospheric engine, it being a single stroke engine. I sometimes intend to use two cylinders, with a lever beam, in which case the power of the engine will be doubled. With the single cylinder, I use a slide, to guide the piston rod and to attach the pitman rods to a fly wheel, in the usual manner.

A forcing pump is placed by the side of the cylinder; from the bottom of this pump, a tube passes through the top of the furnace, and through the fire, to the bottom of the furnace, where it is connected with, and opens into, the lower part of the generator, which it keeps supplied with water. This pump is worked by a connexion with the piston rod of the engine.

The upper part of the tube of the generator, passes out from the side of the furnace, and is bent back, so as to pass into the bottom of the cylinder. This is the only part of the generator, which is exposed to the action of the air, and is of sufficient length only to admit of a safety valve; a throttle valve to regulate the steam, and a cork, or sliding valve to allow it to blow off.

What I claim as new in my engine, is the arrangement of the respective parts so as to prevent the heat from being dissipated, and thus to produce a saving in fuel. This is accomplished, by placing the cylinder so that it may be kept heated by the direct influence of the fire; and by exposing a very small portion of the induction tube, to the cooling influence of the atmosphere.



The above cut, representing one form of this engine, has been sent to us by the patentee. It is without letters of reference, but may be understood from the general description given in the specification.

On Tortoise-shell, and the mode of soldering, and working it, for various purposes.[*]

Tortoise-shell, is the shell, or covering, of the Tortoise, or Turtle, an amphibious animal. Of the Tortoise, there are several species; some of them, however, are without a shell. The *testudo imbricata* of Linnæus, a sea-turtle, found both in Asia and in America, is much sought after; not for its flesh, which, though always agreeable to the palate, is sometimes unwholesome, but for its scales, or covering, from which is made a variety of useful and ornamental articles of great beauty.

There are in this shell, three distinct colours; a light yellow, a brown, and a transparent black. Either one, or two, of these, are in general the prevailing colours; they are, however, commonly found in combination. Tortoise-shell is usually transparent, hard, and easily broken. Although, in its texture, it bears a strong resemblance to horn, it is much less tenacious than this article, in consequence of its fibres being united by a smaller portion of unctuous matter. Tortoise-shell is, nevertheless, very malleable, and by the aid of fire, or of boiling water, acquires a considerable degree of ductility; but after being suffered to cool, it retains the form given to it when heated, and becomes as brittle as at first.

Tortoise-shell possesses the singular property, of becoming perfectly united, or soldered, without the use of any foreign material.

The surface of the shells is generally protuberant, and uneven; it is necessary, therefore, in the first place, to flatten them: for this purpose, they are allowed to remain in boiling water until they become flexible; they are then placed in a press, one above another, with flat plates of iron, or of brass, about two lines in thickness, interposed between each shell; these plates must be made warm, and the press is to be screwed down, a little at a time, and the whole suffered to cool completely, before removing them.

The shell may also be straightened, or bent, by means of fire: for this purpose it must be held before the flame of a clear fire, moving it about constantly, otherwise it will become scorched, and be thus rendered entirely useless. There is no risk whatever in allowing it to remain in boiling water, until it is softened; this method ought therefore always to be preferred: besides, fire always affects the colour in some degree, which is never the case with boiling water.

Method of moulding Tortoise-shell.

Whatever may be the form of the mould used, it must be composed of two parts, similar to those used for casting pewter spoons. A small iron press of sufficient size to contain the mould, will also be wanted.

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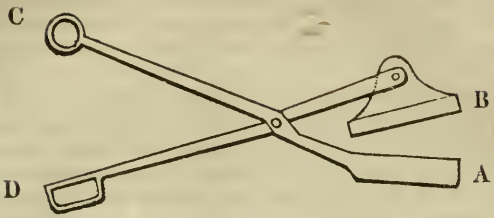
[*] From the Dictionnaire Technologique.

The shell, after having been prepared in the way before directed, is to be brought to a proper thickness by means of a rasp, a tooth plane, or a coarse float, which the workmen call a grale: the shell is then to be softened in boiling water, and the mould having been previously warmed, the piece is to be put into its proper place, and the pins on one half of the mould, made to enter the holes on the other half; the mould is then to be put into the press, and the screw forced down until a slight resistance is experienced; the whole is then to be put into a vessel of boiling water, when the screw is turned, by degrees, until the two parts of the mould are brought into complete contact. When this is accomplished, the press is to be taken out of the boiling water, and allowed to cool. The mould is to be allowed to remain in cold water for a quarter of an hour, before removing the shell, which will afterwards retain the form it has received.

To solder Tortoise-shell.

To solder two pieces of shell together, the two edges which are to be joined, must be bevelled, or chamfered; taking care that the same inclination be given to both, and that they may perfectly fit each other. They are then to be placed, one upon the other, and when the joint is well fitted, a strip of paper is to be wrapped firmly round them, so as to form three or four thicknesses; the whole should be secured by a piece of thread. A pair of pincers resembling small smiths' tongs, or the pinching irons used by hair dressers, must be heated, the mouth of which must be of sufficient length to embrace the whole joint; these are to be squeezed together, until the shell will bend by its own weight, or by the application of a small force with the finger. The tongs are then to be removed, and when cooled, the piece will be found to be perfectly soldered. Care must be taken that the tongs be not too much heated, otherwise, instead of soldering, they will burn the shell: to prevent this, they must be tried by pinching white paper between them; when they are of such a temperature as to scorch it very slightly, they are then fit for use.

The construction of the mouth of the tongs is a point of great moment, and one to which sufficient attention has not been given; in consequence of this, the operation often fails, or is very imperfectly performed. The two jaws ought to preserve a parallel direction, as they approach each other, in squeezing the junctures of the shell; but as they ordinarily move upon a pivot, it necessarily follows, that they are adapted only to an article of the precise thickness for which they were constructed. The writer was consulted by a workman, who was anxious to obviate this difficulty; a plan was suggested which was found to answer, perfectly, and which has been kept secret by the individual to whom it was communicated; but as he has no claim to the invention, and its utility has been proved, the present is embraced as a suitable opportunity of making it public.



The above figure shows the form in which this instrument may be made; the length of the jaws must be governed by that of the longest joints upon which they are to be used. The lower jaw A, is to have its face even, and to make one piece with the lever A C. The upper jaw B, is attached to its lever D, by means of a pin, as is plainly represented in the figure; this pin forms a pivot upon which the piece B, turns freely. It follows from this construction, that whatever may be the thickness of the interposed piece, it will be pressed equally in every part; and should it even be wedge shaped, or thinner on one edge than on the other, the jaws will adapt themselves thereto.

Care must be taken that the substance of metal be about equal in each jaw, in order that they may retain heat for the same length of time.

Sometimes the shell is soldered by means of boiling water, in which case, the two pieces to be joined, must be so disposed that they may be put into the press, with the joint a little overlapping, and embraced between two pieces of metal: the screw is to be sufficiently tightened, to retain the pieces in their proper situations, when the whole is to be placed in boiling water, and as the shell softens, the screw is to be forced down, and when cold, the union will be complete.

In whatever way the soldering is effected, great care must be taken that the two sides of the joint be perfectly adapted to each other; and they must be left clean from the tool, as the most minute portion of grease, or of dirt of any kind, will defeat the operation; they must not be touched by the finger, nor ought the breath to be directed upon them. When pieces are to be soldered, such parts ought to be joined as accord in colour, and in the distribution of their mottle; as the place of the joint will be thus hidden, or rendered difficult of discovery.

Of making articles of fused Tortoise-shell.

Articles made of fused tortoise-shell, have been known in commerce, for a number of years; particularly, very beautiful snuff-boxes which however, are very rarely transparent. The method of making these, was long kept secret. A very skilful workman in this department, who is now established in Brazil, communicated to the writer, his mode of working, and also repeatedly operated in his presence, without enjoining secrecy.

This workman collected all the refuse of the workers in shell, such as the raspings, filings, turnings, &c. which he obtained for a trifling sum; of these, he made round snuff-boxes in the following manner.

He had moulds of bronze, in two pieces, which passed into each other, like troy weights; the lower part, he fixed in an iron frame or press, in the upper part of which was a screw, for the purpose of pressing upon the upper half of the mould; one pair of moulds served for the bottom, and another pair for the top of the box; of these he had fifty different kinds.

In a furnace constructed for the purpose, was placed a boiler, in the form of a parallelogram, which would contain twenty-four moulds, three in width, and eight in length.

The fragments of shell were all broken into small pieces, of which he took a certain quantity by weight; his great practice having taught him the exact portion necessary to form either the bottom, or the top, allowing for that which was to be taken off in turning, and adjusting, his boxes. This quantity cannot be prescribed, but will soon be learned from practice.

Having put the proper portion into each mould, either in small fragments, or in filings, he placed upon it the counter mould, and forced it down with its screw: when the whole twenty-four moulds were thus prepared, he arranged them in proper order in the boiler, the water in which was previously heated very hot. When the water boiled, he forced down the screw of the first moulds, then that of the second, and in like manner of the whole twenty-four; he then recommenced and proceeded in the same way, keeping the water the whole time in a state of ebullition, until the counter mould could be forced no further, which showed that the space between them was entirely filled with the fused shell.

The water in the boiler is always preserved at the same height, the quantity which is evaporated being supplied by a small stream kept constantly running from a vessel placed above the boiler, and heated to ebullition by the same fire. The heads of the screws of each of the frames, project above the water, in order that they may be the more readily turned by means of a key, or wrench. Each of the twenty-four presses must be braced, or wedged, to keep it from moving when its screw is forced down.

It should have been stated, that a deep groove is made on the counter mould of the bottom of the box, around which a circle of handsome shell is placed, which serves to form the rim. This piece is left rough on its outside, which causes it to become more perfectly soldered to the rest of the shell, so as to form with it one entire piece.

When the whole is cold, the moulds are taken apart and the boxes with their covers, removed; upon the exterior surfaces of these, will be found the designs in relief, figures, historical subjects, or, in fine, whatever device may have been engraved upon the moulds; and nothing more is necessary than to put them into the lathe in order to fit them together, and to smooth and polish them, when they are prepared for sale.

When it is wished to cover with tortoise-shell, articles of value, such as ornamental cabinet work, the shell is not applied immediately upon the wood, but after dressing it, and bringing it to a proper thickness, the under side is covered with a black or red cement made of fish-glue, and lamp-black, or vermilion, ground, and well incorporated; upon this coat of coloured cement, paper is immediately laid, and will adhere firmly. This serves to give a good foundation to the shell, and prevents the glue, or the grain of the wood, from appearing through it. The whole is then glued upon the wood in the manner of Veneer. L.

We have heretofore published several articles translated from that valuable work the *Dictionnaire Technologique;* these were taken from Gill's Technical Repository, but having imported the original work, we shall frequently select and trarslate such articles as may appear most interesting. Our artisans will thus have an opportunity of learning the difference in the processes pursued in the two countries, and be frequently enabled to improve their own. As we have a very general knowledge of the technical language of the work-shops, we shall be able to give the information in a style which will be familiar to the mechanic; our translations will of course be free, as we shall adopt those modes of illustration which appear best calculated to attain the proposed end. The *Dictionnaire* is not yet completed, having only reached the letter H.

We have repeatedly performed the process of soldering tortoise-shell, and have always done it without any difficulty, by means of boiling water. The shell to be soldered, should be reduced as little as possible in thickness, as in forcing the two ends together, a depression, or groove, is produced on each side of the joint, which, if the shell be thin, cannot be completely turned, or filed out. The only purpose for which we have undertaken this, was to form rims for snuff-boxes; but the most perfect and beautiful specimens which we have seen, have been walking sticks manufactured in France, and in India. These were formed of one perfect tube, which, of course, consisted of strips, soldered together, and afterwards bent round, and united their whole length; this was done so neatly that the place of juncture could only be discovered by narrowly inspecting the occasional abrupt terminations of the coloured clouds in the shell.

We think it probable that a less degree of pressure may answer with the heated iron, than with the boiling water; in which case, thinner shell may be united, but of this we cannot speak from experience. For the mode of polishing, see Vol. 2, p. 236. Editor.

On the beneficial effect of a Lightning Conductor, on a Ship recently struck by Lightning at Sea.

The following is the letter to which Professor Hare alluded in his communication in a former part of this number, it was first published in the "Liverpool Commercial Chronicle," and has since appeared in several English and American journals.

Ship New York, Prince's Dock, Liverpool,
May 11, 1827.

Sir,—I trust, that, although a stranger, I shall find a sufficient apology, in the very uncommon nature of the occurrences herein described, for troubling you with the detail of the following particulars. This ship has been twice struck by lightning on her present voyage from New York. On the 19th of April, our third day out, in the Gulf stream (lat. 33, 9, n., long. 61, 17, w. at noon,) about half past five in the morning, being in our births, we were roused by a sound, like the report of a heavy cannon close to our ears. In a moment we were all out; and the cabin, and all parts of the ship were filled with a dense smoke, having a strong smell of sulphur. From the deck the word was quickly passed, that the ship had been struck with lightning, and was on fire. The consternation which for some minutes prevailed, may be more easily imagined than described. Every one ran on deck with the full impression that the ship was in a blaze. Then all the elements were in violent commotion. It had been broad day, but so dark, so dense, and so close upon us were the clouds, as to produce almost the obscurity of night. There was just sufficient light to give a bold relief to every object in the appalling scene. The rain poured down in torrents, mingled with hail-stones as large as filberts, which lay upon the deck full an inch thick. Overhead blazed the lightning on all sides, accompanied by reports almost simultaneously, thus evincing its nearness. The sea ran mountains high, and the ship was tossed from one wave to another with incredible rapidity. One appearance was particularly remarkable: the temperature of the water was at 74 deg. of Fahrenheit, while that of the atmosphere was down to 48°. This produced a copious evaporation, and caused immense clouds of vapour to rise, which, ascending in columns all around us, exhibited the appearance of innumerable pillars, supporting a massive canopy of clouds. These phenomena are extremely unusual; no person on board having ever witnessed any thing like them before. In all directions might be seen water-spouts, which, rising fearfully to the clouds, seemed actually to present to the eye a combination of all the elements, for the destruction of every thing on the face of the deep. Altogether the scene was of that awful sublimity which baffles description. Amid this scene of impending ruin, when all nature was in the utmost confusion—when nautical science and experience could avail nothing—while an irresistible element was raging about us, and the ship seemed on the very verge of destruction—when, in short, dismay and despair were reflected from every other countenance, nothing could exceed the calm tranquillity of Captain Bennett—nothing could excel the firmness with which the order was given for examining the ship, in expectation of meeting fire below deck—nothing could equal the manner in which every one was encouraged with the hope of security, even beyond what in reason could be expected. Thus I but echo the sentiments of all on board.

But I hasten to my narrative. Some parts of the ship and spars were for a moment on fire, but were quickly extinguished by the rain. The ship was then thoroughly examined, to ascertain whether the electric fluid had penetrated among the combustible part of the cargo below the lower deck. This investigation disclosed the following facts:—The lightning having struck the main royal mast-head, shattered the mast-head, and descending thence, penetrated the deck into one of the store-rooms, the bulk heads and fittings of which are completely demolished. Then separating, one part was conducted by a leaden tube, to the side of the ship, through which it passed out between wind and water, starting the ends of three five-inch planks; another portion from the store-room passing into the ladies' cabin, shivered to atoms the plate of a large mirror, leaving the frame uninjured. From the looking-glass to the piano-forte was an easy transition; it touched the instrument with no delicate impulse, dismounting it, and leaving it out of tune. Thence it passed through the whole length of the after-cabin, and out of the stern windows. Fortunately we were all in our births at the moment. Upon these facts I would venture briefly to remark, that the mast-head was bound by four iron hoops, say from two to three inches wide, and nearly half an inch thick. These attracting the fluid, and being themselves insulated by other less powerful conductors, would naturally at the instant accumulate a large body of the fluid, which, by the violence of its action, burst the hoops asunder, and shattered the mast-head and cap. Into the cabin store-room it seems to have been conducted by a leaden pipe, near the main-mast, under the deck. The quicksilver on the back of the mirror was sufficient to attract it thither, when it would be diffused over the whole surface of the glass, which being the most perfect non-conductor known, was thus shattered into countless pieces. The atmosphere being very moist, the dampness of the cabin floor, for want of a better conductor, might probably aid in carrying it to the windows.

Being all in our births, enveloped in beds and bedding, of non-conducting materials, we reposed in comparative safety, while the deadly bolt acted around us with fierce and resistless energy. Doubtless, a feather-bed is the most safe retreat in such cases. Had it been later in the day, and the passengers about the cabin, the chances are, that it would have been fatal to many of us.

The operation of the second shock was very different from the former, and is most deserving of attention, as furnishing a new instance, in proof of the efficacy of lightning-rods, as a protection at sea. We had a chain conductor on board; but it not being the season to expect much lightning, and the first shock coming on quite suddenly, it was not up at the time. The morning squall was over; it continued, however, to blow fresh all the day, and about noon heavy clouds began to gather on every side, rolling their volumes apparently among the rigging. We had reason to expect more lightning; the conductor was prepared, and Captain Bennett ordered it to be raised to the main royal mast-head. It consisted of an iron chain, having links, one-fourth of an inch thick, and two feet long, turned in hooks at each end, and connected by rings of the same thickness, and of one inch annular diameter. This chain was fastened to a rod of iron, half an inch thick, and four feet in length, with a point well polished and tapered, in order to receive the fluid with facility; it was secured to the main royal mast, the rod extending two feet above the mast-head, and thence it was brought down over the quarter, and stretched over an oar, protruding say ten feet, from the ship's side, and finally sinking a few feet below the surface of the water.

Dr. Franklin was of opinion that a rod of this size would sustain without injury, the severest shock of lightning. I have been thus minute in stating the dimensions of the chain, for the double purpose of conveying some idea of the force of this shock, and of enforcing the necessity of providing larger conductors. The chain, however, in this instance, performed its office, and it was up in happy time to avert a blow, that, in the opinion of all on board, must have sent this stanch vessel, in an instant, to the bottom of the ocean.

Soon after one P. M. we saw lightning: a little before two, observed a very smart flash; looking at my watch, which marks seconds, I counted four, when the report followed; I felt no alarm, however, having frequently known it to approach nearer without any injury. At two o'clock we were astounded by another shock, like that in the morning: the flash and sound simultaneous. I happened to be in the cabin with another passenger: a ball of fire seemed to dart down before us: at the same moment the glass in the round-house came rattling down below. Those on deck agreed that the whole ship appeared to be in a blaze, from the vividness of the principal flash, which they distinctly saw darting down the conductor, and agitating the water. All parts of the ship, as before, were filled with smoke, smelling of sulphur.

The ship was again thoroughly examined. The conductor had been rent to pieces by the discharge, and scattered to the winds; small fragments of it were found on the deck; in saving the ship, it had literally yielded itself to the fury of the lightning! The pointed rod was found to be fused and shortened several inches, and covered over with a dark coating; some of the links had been snapped off, and others melted. The whole operation was singularly striking, and affords another of those rare cases, where the conductor yielded to the violence of the shock, while it effectually averted the bolt from the object it was designed to protect.

This was a property of the rod of which Franklin was satisfied very early after the application of a theory, which has disarmed the lightning of Heaven! One of the earliest cases which fell under his notice, I believe, occurred in one of the Dutch churches in New York: a chain, connected with the clock, probably, saved the church much damage, but the chain itself was melted.

Mr. Ross, the second officer, was prostrated, and three of the men struck, but none much injured. It affected the polarity of all the compasses, causing them to vary from the true point, and between each other. They gradually assumed a bearing, by which we steered, though still three points out, as we have just discovered. The captain's chronometer was very materially affected; it usually crosses the Atlantic without varying three seconds, it has now proved to be out of time as many degrees! Curious as are these effects, they are still more interesting in a scientific point of view. Such facts, carefully noted down at the time, afford useful data in the cause of experimental philosophy. Thus collected, they are at our disposal. When it is considered that not one vessel in fifty is prepared with a conductor, cases of this kind ought to admonish ship owners of their utility. Capt. Bennett is determined to go well armed with them in future. It would be well to have one ready to be raised at each mast, in case of emergency; and for the safety of the chain, it ought to be half an inch in diameter.

'We have visited,' says the editor of the Liverpool Chronicle, 'the ship since her arrival, and the traces which remain of the operation of the first shock, together with the concurrent testimony of Captain Bennett and his mates, and the state of the iron rod, and such portions of the chain conductor as have been preserved, which, for the present, may be seen at our office, have served to convince us of the general truth of the foregoing letter, and of the singular good fortune attending the timely application of this simple, but philosophical invention of the admirable Franklin, which no ship should be without. Many additional particulars were recounted to us by Capt. Bennett, which the pressure of other matter, and the shortness of the time remaining to us, prevent us, at present, from repeating. The following circumstance, however, communicated to us by Roskell and Son, chronometer makers, of Church street, Liverpool, are too interesting to be passed over. Captain Bennett's chronometer, after preserving for a considerable length of time, a uniform rate of 7-10ths of a second gaining, and, being nine minutes, forty-two seconds slow of Greenwich time, when the vessel left New York; was found, when compared in Liverpool, to be 24 minutes, 33 seconds fast of Greenwich; and three lever gold watches, belonging to three gentlemen, passengers by the ship, contracted the magnetic power to such a degree, as actually to require the principal part of the steel work to be renewed.'

'Such is the effect,' observes a correspondent, who has transmitted us the above account, 'produced on the steel work in the watches, that they have the power of the magnet, so far as to act the same as the loadstone.'

On an Unfinished Time-Piece, of the late celebrated Mr. Harrison, *in the possession of* John Barton, Esq. *of the Royal Mint.* By Thomas Gill, Esq.

Having been recently favoured with a sight of this time-keeper, which, as above mentioned, was left unfinished by Mr. Harrison, at the time of his death, we think it cannot but be gratifying to our readers, to be furnished with some particulars respecting it.

In the first place, Mr. Harrison has been careful to avoid the employment of either *iron*, or *steel*, in the construction of the several parts composing it; possibly, from having experienced the liability of those metals to become injured by rust; and therefore he has substituted either brass, gun-metal, tutenague, bell-metal, or even hard wood, in place thereof.*

The arbors are, some of them, made of a composition resembling tutenague, or fine bell-metal, and others are made of gun-metal. The wheels, and frame-plates, are made of fine Flemish brass; and the pallets of the escapement are made of *hard wood*.

The wheels are of a considerable diameter, but made exceedingly thin and slender, so as to press with as little weight as possible upon their necks or pivots, and which pivots are also reduced in thickness as much as possible. The strong pivots of the great arbor are, however, each surrounded with rings of four friction rollers, turning in larger cylindrical holes, made in the frame-plates, of the time-piece, and connected together by flat circular rings, which keep the rollers at a proper distance apart, and revolve with them; in fact, *they are of the very same construction as Garnet's patent friction wheels;* which, however, were patented long after these of Mr. Harrison's were made. The slender pivots of the arbors of the other wheels, each rest, and turn, upon the peripheries of two large, and light, friction wheels.

The slender teeth of the wheels are merely formed in radii lines, with rounded tops; and for pinions, lanterns or rundles, are substituted, with wooden rollers, or cylinders, around them, the rollers having small holes in their centres, which turn upon slender pins of brass, fitted into holes made in the two circular plates, which constitute the frame of each lantern. In the time-pieces at the Royal Observatory at Greenwich, for which Mr. Harrison was rewarded by government, and in several clocks made by him, these wooden cylinders turned upon steel conical points.

The hard wood pallets of the escapement are mounted upon an arbor, having knife-edges at each end of it, resting upon agate bearings; and the pendulum spring was hung between adjusting cycloidal cheeks.

Mr. Barton, we understand, is constructing a grid-iron pendulum for this time-piece; and, when finished, we shall see the result of all this extraordinary provision of Mr. Harrison to obviate friction, and to avoid oxidation.

It certainly furnishes a remarkable instance of the excellence of workmanship, and the care bestowed by Mr. Harrison upon his time-pieces; and we are glad that it fell into Mr. Barton's possession, who has preserved it in perfect order, and has put it into Mr. Wm. Hardy's hands to complete it, and fit it for performing.

[*Technical Repository*.

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* The tendency to rust, is not the only objection to the employment of steel in the construction of time-pieces: the permanent magnetism which this metal acquires, is, in chronometers, and other delicate instruments, a troublesome source of error; and although in the larger time-keepers a substitute may be found, we are almost forbidden to hope for it in the smaller.—EDITOR.

Description of an Improvement in Sir Humphrey Davy's Miner's Safety Lamp. By J. Roberts, *of St. Helen's, Lancashire.*

The only real objection to the use of Sir H. Davy's safety lamp for coal miners, is the inferior degree of light that it affords, when compared with that given by a naked candle. This arises from two causes, namely, the necessary obstructions offered by the black wire of which the cage or gauze is composed, within which the lamp is placed, and the casual obstruction occasioned by the adhesion of smoke to the inside of the cage, when the lamp is not carefully trimmed, and of smut, and dust, to the outside of the cage.

To diminish the obscuration occasioned by the first cause, Mr. Roberts proposes that the wire shall be kept bright and polished, by cleaning the cage every night with a soft brush, and the black powder, or smut, which occurs in all coal mines, especially in the neighbourhood of faults: this smut is a pulverized, non-bituminous coal; sufficiently hard to remove the rust from the surface of the wire, without materially wearing the wire itself.

As the lamp is at present constructed, the oil will run out of the cup or receptacle in which it is placed, if the lamp is laid in a horizontal position; an accident which frequently occurs, on account of the lamp being rather top heavy. When this happens, the gauze becomes smeared over with viscid oil, which causes the coal dust floating in the air of the mine, to adhere to it, and in a short time to fill up, more or less, the meshes of the gauze. By merely shaking or tapping the lamp, the dust will not be dislodged; and if the miner attempts to clear his lamp by blowing through the wire gauze, he runs the risk of putting out the light, and after all very imperfectly clears the meshes; there is also perhaps, some risk of forcing the flame through the meshes on the opposite side, and of producing an explosion, if the surrounding air is inflammable.

In Mr. Roberts's lamp, the overflow of the oil is impossible, on account of the dome-shaped cover which surrounds the wick: the dust, therefore, that settles on the gauze, may be dislodged by a mere tap with the finger, or what would perhaps be better, by the application of a small brush similar to that which soldiers carry to clear the pans of their muskets, and which might be attached, by a bit of small chain, to the handle of the lamp.

Plate III, fig. 6, is a section of the lamp *p*, *p*, and wire gauze *q*, *q*; *r*, *r*, a screwed cap, with a hollow dome *s*, it screws into the neck, *t*, *t*, of the lamp: the dome rises a little above the wick-holder *u*, having an opening at top, to let the wick and trimming wire *v*, rise through. This dome serves to catch, and retain, any oil that may spill by shaking the lamp, or knocking it over, thereby protecting the wire gauze, *q*, from being smeared; *w*, and *x*, two locks, the former to secure the cap g, and the latter to secure the wire gauze *q*, from being removed.

Fig. 7, a section of the cap and dome *r*, *r*, *s*, separate from the lamp: the wire gauze fits into the cavity *y*, *y*, around the dome *s*: *z*, *z*, two of the four wires which serve to hold the wire gauze.

[*Newton's Journal.*

Description of a bent Lever, and Weight, for Closing Doors.

Mr. Adcock has invented and communicated to the Society of Arts, an apparatus for closing doors, to be employed instead of spring-hinges. It consists of a bent lever attached to an axle, from which axle, an arm extends, carrying a weight. A small roller affixed to the top of the door, acts against the under side of the bent lever, raising it as the door opens, which lifts the weighted arm; and the force of this weight, acting by means of the bent lever, in an oblique direction against the roller, closes the door, with a force that may be regulated by adjusting the weight upon its arm.

Plate III, fig. 8, represents the apparatus attached to a door, as it would appear when viewed sideways, the door being closed. Fig. 9, represents the same raised, the door being open; *a* is the friction roller affixed to the top of the door; *b*, the bent lever, against which the roller acts. This bent lever is formed something like a ram's horn, being so curved that the roller acts constantly against the under side of it, as the door swings upon its hinges; *c*, is the pivot of the axle on which the lever turns; *d*, is the weighted arm extending from the axle; and *e*, is the weight adjustable upon the arm, and thereby increasing or diminishing the force by which the door is closed.

The particular advantages proposed by the use of this lever are as follow:

1st. Its force may be varied with facility, according to circumstances, so as partly to prevent the inconveniences produced by changes of the wind, and by particular draughts, which occasion the violent jarring of certain doors, the power of whose weights, or springs, upon ordinary occasions are not sufficient to shut them.

2nd. It is also capable of any disposition of force which may be deemed eligible, or of being so made as to exert its greatest force upon the door while open to any particular angle, causing it to shut with an increasing or decreasing velocity, to latch violently, or merely to close.

3d. As it acts with but little friction, it will perform its operations unheard, or without causing the least unpleasant or disturbing noise, as is frequently experienced in the modes hitherto adopted.

4th. It will be found applicable to any door opening only to a right angle with the post, and may be applied without interfering with the hanging of the door.

5th. Its construction being extremely simple, the expense will be trifling, and as it is not liable to be deranged, it will continue to act as long as its materials will last.

This lever has the desirable quality of holding the door very tight when closed, and thus resisting the wind, and acts gentler the wider the door is opened, so as not to strike with violence against any person following, as will be seen in fig. 9: the distance of the roller *a*, from the fulcrum or axis *c*, is shortest of all when the door is shut, being about one-eighth of the distance of the weight *e* from the same fulcrum; whereas, when the door is open, the position of the roller is directly under the weight *e*; thus with an equal slope throughout the lever *b*, the change of force is gradual, that is, equal in equal times; while by varying the slope, any proportion of force, in any part, can with the greatest ease be obtained, and by a hollow in the end of the lever, farthest from the weight, it may be made to hold the door open if required. The ball is fastened to the arm by a pin, which pin being passed into any one of the holes, along the top of the arm, detains the weight, at the required place. The hole through the weight being wider under the pin than is necessary for the reception of the lever, allows the pin to be raised out of any hole, and transferred to any other at pleasure; the leverage, therefore, may, without difficulty, be adjusted to suit the most windy, or the most quiet day. When there is sufficient thickness in the wall above the door, the whole of the apparatus may be concealed, by letting the door turn upon an axis, which rises through the frame, above the door, sufficiently high to allow the descent of the lever *b*, and it must have a short arm on its top, at right angles with the door, to carry the roller *a*, at its end; the arm will then be parallel with the wall, and concealed within it, and as the arm on the axis and the curved lever must be lessened to suit the thickness of the wall, the weight must be increased, or the arm lengthened, to gain sufficient power. [*Ib.*

Comparative merits of Flint and Percussion Guns.

Sir,—The question respecting the comparative merits of the flint and percussion principles, as applied to guns, never having, I believe, been decided, and a sporting author, who has lately written much on the subject of guns and shooting, having broadly asserted that guns, on the flint principle, had the advantage, I have lately been induced to make trial of the *two* plans, on the *same* gun, and at the *same* time, in a manner which I, as well as many experienced sportsmen to whom I have submitted it, deem very satisfactory; and, as the result may be of interest to many of your readers, you will perhaps favour it with a place in your valuable magazine.

The experiment was made in December last, with *two* guns, and on three successive days. The guns were on the percussion principle, with copper caps, and made by myself. I first stopped up the nipple, or touch-hole, and into the vent-hole I screwed a small pan with a train of gunpowder in imitation of a *flint* gun, and fired my *first* shot in this way; igniting the powder in the pan with a match. I then put in the nipple or touch-hole, and fired the *second* shot with a copper cap; and so changed every shot, from one plan to the other, alternately. The annexed table will show the produce of each shot; the first being No. 1, in the *flint* column, the second No. 2, in the percussion ditto; thus a round of twenty-four shots was fired, as numbered in the tables, 1, 2, 3, 4, 5, &c. being eight shots each day. The strength, or penetration, was also ascertained in the same way; the shot used, averaged 254 to the oz.; the target, 21 by 19 inches, and the distance, 40 measured yards. It will be seen from this statement, that the *percussion* principle was decidedly the best in garnish as well as in strength, being a complete refutation of the above assertion. The kind of wadding used on this occasion, is what I term *woollen paste-board*, in the *flat* form; and I would here observe, while on the subject of wadding, that the *flat* form is decidedly superior to the concave; whether the wadding be made from hempen or woollen paste-board, leather, or felt; this has been proved in a recent experiment, after two days' trial of the different kinds of wadding, before a committee appointed for that purpose.

I am, sir, your obedient servant,
SAMUEL NOCK.

Garnish.				*Strength.*				
Flint.		Percussion.		Flint.		Percussion.		
No. 1	78	No. 2	81	Thro'	20	Thro'	27	Sheets of brown paper, wt. 2lb.
3	80	4	92	—	22	—	28	——
5	71	6	75	—	28	—	28	——
7	94	8	62	—	28	—	27	——
9	97	10	93	—	20	—	25	——
11	99	12	100	—	20	—	24	——
13	69	14	86	—	22	—	26	——
15	100	16	108	—	27	—	24	——
17	102	18	120					
19	108	20	107					
21	85	22	109					
23	101	24	101					
	12) 1084		12) 1134		8) 187		209	
	Average 90—4		94—6		Average 23—3		26—1	

[*London Mechanics' Mag.*

On the Antiquity of the use of Wheels for Oars, in the manner now practised for propelling Steam Boats.

"During Papin's residence in England, he had witnessed an interesting experiment made on the Thames, in which a boat, constructed from the design of the Prince Palatine, Rupert, was fitted with *revolving oars*, or paddles attached to the two ends of a long axle going across the boat, and which received its motion from a trundle working in a wheel turned round by horses. The velocity with which this horse-boat was impelled was so great, that it left the king's barge, manned with sixteen rowers, far astern in the race of trial.

"The use of wheels for oars is very ancient. In some very ancient MSS. extant in the king of France's library, it is said the boats, by which the Roman army under Claudius Caudex was transported into Sicily, were propelled by wheels moved by oxen. And in many old military treatises the substitution of wheels for oars is mentioned.

"Robert Valturius gives a view of two gallies moved by *wheels* instead of oars: the first diagram shows *five* wheels on each side of the vessel; each pair are connected by a separate axle running across the boat, this axle is formed like a crank in the middle of its length, and the five axles are connected together by a rod, or a rope, so that all their movements are simultaneous. The second diagram has one wheel at each side of the galley; these are also connected by an axle running across the boat, as shown in the figure: he gives no details, but he merely mentions, that the velocity of these boats will be greater than if they were propelled by oars. *De Re Militari*, lib. xi. p. 2. Veronæ, 1472.

"Pancirollus, a celebrated professor at Padua, in 1587, saw an ancient bass-relief, which represented a galley with three wheels on each side of a boat, turned by three pair of oxen. And he observes, that they would have a greater velocity than the swiftest three-decked gallies. *Res Memorabiles*, p. 127. Ambergæ, 1599.

"An old English writer on military subjects says: 'And furthermore you may make a boate to go without oares or sayle, by the placing of certain wheeles on the outside of the boate, in that sort, that the armes of the wheeles may goe into the water, and so turning the wheeles by some provision, and so the wheeles shall make the boate goe.' *Invention, or Devises, by William Bourne,* p. 15. London, 1578.

"Edmund Bushnel, a shipwright, describes 'a mode of rowing ships by heaving at a capstan, useful in any ships becalmed.' He connected the oars on each side of the vessel together, and he gave them the alternate backward and forward movement, by attaching the connecting pieces to ropes which were wound and unwound by the capstan. *Compleat Shipwright*, p. 56, fourth edit. 1678.

"*A horse 'tow-vessel'* was used at Chatham in 1682. It was constructed with a wheel on each side of the vessel, connected by an axle going across the boat, and the paddles were made to revolve by horses moving a wheel, turning by a trundle on the axle. It drew but four and a half feet of water, and towed the greatest ships by the help of four, six, or eight horses: the wheels were permanently fastened to the side of the boat; the capstan to which the horses were yoked, was not that of the boat. *Savery's Navigation Improved*, p. 13, London, 1698. This, probably, is the identical vessel constructed from the design of Prince Rupert."

[*Stuart's Anecdotes of Steam Engines.*

Food for Horses.

A PRACTICE is becoming general in Silesia of feeding horses with bread, made by taking equal quantities of oat and rye meal, mixing it with leaven or yest, and adding one third of the quantity of boiled potatoes. To each horse is given 12lbs. per day, in rations of 4lbs. each. The bread is cut into small pieces, and mixed with a little moistened cut straw. It is stated that by this means there is a saving in feeding seven horses "of 49 bushels of oats in 24 days, while the horses perform their common labour, and are much better in look, health, and disposition."

Another improvement in the feeding of horses, which has just been announced by the Rev. W. Evans, of Llandefeilog, Carmarthenshire, consists in the substitution for hay and corn, of cut straw and potatos, or straw, chaff, and pounded furze mixed, wetted with salt water. The process of preparing it is as follows; "Let a tub full of fresh water, with an egg in it, be impregnated with as much domestic salt as will cause the egg to rise and float on the surface, that being the criterion of its saltness, being equal to that of sea water. The provender being put into a wicker basket, and placed on the tub, pour the salted water upon it, in quantity sufficient to wet the whole mass, and when it shall have done filtering through it, give it to the horses. The salted water will not only moisten and sweeten the food, but also operate as a most efficient alterative to purify the blood, purge all gross humours, prevent the increase of worms, and all painful attacks from those troublesome vermin. Horses fed in this manner will work well, and will be fit for all sorts of work. A man cuts with one knife machine, in four hours, enough of wheaten straw to last nine horses for twenty-four hours."

Diamond Microscope.

[From the Quarterly Journal of Science.]

Of all the various substances furnished, either by nature or art, the diamond seems to be that most pre-eminently calculated to form small deep lenses for single microscopes, possessing a most enormous refractive power, combined with a low dispersive one, together with a very little longitudinal aberration. Mr. Andrew Pritchard, 18, Picket street, Strand, has succeeded in forming a very thin double convex lens, of equal radii, and about 1-25th inch focus, from a very perfect stone of the finest water. Its polish is very beautiful, and by its strong reflective power, at once informs us of the peculiar and invulnerable material of which it consists, while the large angle of aperture which it bears, attests the faintness of its spherical and chromatic aberration. It appears from experiment, that, though the refractive power of different stones varies considerably, if a diamond and a piece of plate-glass are ground in tools of the same figure and radius, the magnifying power of the former will surpass that of the latter, at the rate of eight to three; so that if the power of the glass microscope should be 24, that of the diamond one will be 64! What a lift does this give us in the construction of deep single microscopes! If a diamond was ground in the same tools which had produced a glass lens of 1-75th of an inch focus (which it would be very possible to do, and which we believe Mr. P. would undertake to effect,) it would turn out about 1-200th of an inch focus; but this is by no means the only valuable property it would possess; for Mr. G. Francis has been at the pains of calculating the value of the spherical aberration of a plano-convex diamond, with its curvature exposed to parallel rays, and finds it only 0.949 of its *thickness*, while that of glass is known to be 1.166, *cæteris paribus*. This difference would be very considerable, even if the thickness of a glass and diamond lens, of the same focus and diameter, was the same; but this is, of course, far from being the case, owing to the immense refraction of the diamond, which gives a very short focus, with a very shallow curve, and proportional thinness. If a diagram is made of the curve of any two lenses of the *same* penetrating and amplifying power, formed of glass and adamant separately, it will at once show what their spherical aberration amounts to; being enunciated in terms of their thickness, as stated above, and which, of course, is the same, whether they have their curved surfaces exposed to parallel rays, or their flat sides to divergent ones, from a radiant point in their focus, when used as magnifiers. If we select a hemisphere of glass, having its aperture equivalent to its focus, which is absolutely necessary for exhibiting certain test objects, and calculate the longitudinal aberration of a diamond of the same power and calibre, it will be found less than one sixth of that of the glass! Again, the chromatic aberration of the adamant is very little more than that of a drop of water of the same radius, which is scarcely felt at all, when the stone is used only as a single microscope; so that we thus obtain a kind of *natural aplanatic lens*, capable of being carried to an enormous power, which is, in fact, the very *beau ideal* of the single microscope, necessarily the most perfect instrument of all, when divested of aberration. Of all the improvements in microscopes which have been originated by Dr. Goring, this is, perhaps, the most important, and the most likely to extend discoveries in minute nature.

As many individuals have chosen to doubt of the possibility of working diamonds into spherical curves, Mr. Pritchard will be proud to exhibit his instrument to amateurs of microscopic science.

Mirage, in Persia.

The wonderful effects of the mirage, and the phenomena it produces, have frequently been the theme of admiration with travellers; but it is almost impossible to conceive the extent to which these prevail upon the wide and level plains of these countries, when the air, in a state of rapid undulation, causes every object near the surface, to tremble into forms as uncertain and evanescent as the eddies that produce them. A distant mountain, in the space of a minute, will assume, first, perhaps, the form of a lofty peak; this, after rising to what appears a prodigious elevation, will thicken at the top, and spread into that of a large mushroom, with a slender stalk; the top will then split into several spires, and then all will join into a solid table shape. This is extremely puzzling to a surveyor, who depends upon the peaks of mountains, as objects from which to form his triangles; for he may be thrown many degrees out of the true line, by trusting to an observation made under such circumstances. In other instances, a mud-bank, furrowed by the rain, will exhibit the appearance of a magnificent city, with columns, domes, minarets, and pyramids, all of which flit as you approach; till, to your utter confusion, they dwindle into a heap of earth, perhaps not ten feet high. Numberless have been the mistakes made, of asses with boys on them, for elephants and giants, or well mounted troops of cavalry; sheep and goats, for camels and dromedaries; and the smallest bushes, for fine forest trees. There is sometimes great beauty, and much that is amusing, in the variety of phenomena produced, but they not unfrequently involve the weary traveller in great disappointment.

[*Fraser's Travels.*

Analysis of a Powder, which is sold in Paris under the name of Colour, and used in giving trinket gold, the colour of fine gold.

Cupidity and ignorance, have often issued in commerce, under different names, a multitude of more or less noxious substances, to which extraordinary properties have been attributed; and the credulous public, having no suspicion of the dangerous properties which these substances often possess in a very high degree, and according to which they exert a specific agency, are frequently exposed to the most serious accidents. Secret preparations of this kind, cannot be too well made known, nor can too much publicity be given to their composition, and the analysis that may be made of them; the knowledge of the results of which, may be so eminently useful to society. The powder which the trinket-manufacturers used to apply for the purpose of colouring gold, was composed of marine salt, nitrate of potash, and alum; but, for some time back, another substance has been vended, the composition of which, is different. This powder is of a dirty white colour, having a tinge of red, its taste is salt, and like that of common sea salt, but it leaves a disagreeable metallic taste in the mouth; and it sensibly attracts moisture from the air. Its analysis has furnished the following results. Twenty grammes of it have yielded,

Of pure white oxide of arsenic - -	2,135
Alum, with a base of potash, - - -	4,190
Marine salt, - - - - - -	13,560
Oxide of iron and argil, - - - -	0,115
	20 grs.

If this powder be really used for colouring gold, as I have been assured, the oxide of arsenic, I should think, can have no effect in that way.—*M. J. L. Casascca.*

Note by M. D'Arcet.—I have several times had occasion to examine the saline composition known under the name of *colour*, which is employed by the toymen, for giving to trinket gold, the beautiful yellow colour of fine gold. The following is the result of my analysis, in round numbers:

Saltpetre, - - - - - - -	40
Alum, - - - - - - -	25
Sea-salt, - - - - - - -	35
	100

I was not aware that any change had been made in the composition of this mixture. If the powder, examined by M. Casaseca, be now used for colouring gold, it can only have been adopted of late, and since fashion has introduced the taste, and rendered necessary the employment of variously coloured alloys of gold with silver, copper, iron, antimony and platina. M. Casaseca's observations appear to me to be very important, and will, without doubt, induce authorities to adopt measures of administration for obliging the persons who prepare, vend, or employ the new composition in question, to employ all the necessary precautions against the danger arising from the use of a mixture containing so much oxide of arsenic.

[*Annales de Chimie, et de Physique, Mar.* 1826.

Opposite effects of a change of density of the air, as affecting the going of a Clock.

Davies Gilbert, Esq. M. P. a short time ago, published some ingenious investigations on the vibration of pendulums, and showed, that on a change of an inch, in the height of the barometer, an astronomical clock ought to change its rate, in consequence of the alteration in the buoyancy of the air, by two-tenths of a second a-day. Having applied to Mr. Pond and Dr. Brinckley to examine this point, he was surprised to find that they had discovered no such change. On reconsidering the subject, he finds a cause which, before, he had supposed too small to have any effect, almost exactly counterbalancing the effect of the change of buoyancy. This cause, is the alteration of the arc by the altered resistance of the air. He remarks, "it is an extremely curious circumstance, that, without any reference to the attainment of this balance between opposite disturbing causes, our best clocks should have been fortuitously made to vibrate very nearly in the arc which reduces them to equality." For the mathematical investigations and tables illustrative of this singular coincidence, we must refer to the Quarterly Journal of Science for October.

[*Dublin Philosophical Journal.*

The Bark of the stem of the Pomegranate, a specific in the cure of Tænia, or Tape Worm.

P. Breton, Esq. says, "I have repeatedly put to the test of trial in cases of tænia, with uniform success, the dried bark of the stem of the pomegranate shrub, both in decoction and in powder, without exciting any other sensation than those which arise from the fresh bark of the root of the plant. I have also ascertained by frequent trials, that the virtues of the bark may be preserved several years; a circumstance favourable to its transmission to Europe. Some bark of the stem which I have had upwards of four years, packed in a deal box, I have recently tried in several cases of tænia with perfect success; so that I have no hesitation whatever in recommending this drug not only as a safe, but as a perfectly certain remedy for expulsion of tænia. This drug is equally efficacious in expelling from the lower animals (especially dogs,) tænia, to which they are particularly subject in this country. To full grown dogs may be given the same dose as that taken by adults. The powder mixed with butter or minced meat, is as good a form as any; some dogs will of themselves eat it when prepared in this manner. The powder may also be given in balls, or the decoction may be substituted with equal effect. We are indebted, it seems, for our knowledge of this invaluable remedy for the tape worm to a mussulman fakeer, named Azimshah, who, in 1804, having relieved in a few hours, Mr. Robert Home, of Calcutta, of a tænia which measured 36 feet in length, was prevailed on by a reward of two gold mohars, to disclose the secret.

[*Trans. Med. Soc. Calcutta.*

Sympathetic Ink.

The following application of a modern chemical discovery, has never before been communicated to the public, and affords a sympathetic ink very far superior to any, as yet, in use. Dissolve a small quantity of starch in a saucer, with soft water, and use the liquid like common ink: when dry, no traces of the writing will appear on the paper, and the letters can be developed only by a weak solution of iodine in alcohol, when they will appear of a deep purple colour, which will not be effaced until after long exposure to the atmosphere. So permanent are the traces left by the starch, that they cannot, when dry, be effaced by Indian rubber; and in another case, a letter which had been carried in the pocket for a fortnight, had the secret characters displayed at once, by being very slightly moistened with the above mentioned preparation. [*New Monthly Mag.*

Notice of "Hale's Introduction to the Mechanical Principles of Carpentry."

An octavo volume, of about 180 pages, under the above title, has been just published, by Richardson & Lord, of Boston, and P. Sheldon, of Gardiner, Maine. The work is written by Mr. Benjamin Hale, principal of Gardiner Lyceum. It is divided into two parts, the first treats of the *strength and stiffness of timber*, and the second of *statics applied to constructions of timber*. We have perused this volume with much satisfaction, and recommend it as calculated essentially to aid the operative carpenter in the prosecution of his business. It does not pretend to much originality, and had it done so, we should have thought it a very unfavourable symptom; much valuable matter has been published upon this subject, but it is usually contained in works which are inaccessible to the ordinary workman, on account of their cost; and which to most of them wear a repellent aspect, in consequence of the extensive use of algebraic formulæ: for however desirable it may be, and is, that the mechanic should be well acquainted with the arithmetic of signs, the time is not likely soon to arrive when this knowledge will be general. To the work before us, neither of these objections can be urged.

Mr. Hale has made free use of Tredgold, Robison, Barlow, and others, either copying them verbatim, or moulding them so as to suit his purpose, and has thus produced a work, which, whilst it is moderate in cost, is neat in its execution, and valuable from its matter. The subjects are illustrated by 82 figures, executed with remarkable neatness. We are informed in a note that "The cuts in this book were made by Mr. L. T. Jackson, of Brunswick, Maine, of *brass rule*, according to a method recently invented by him. These are the first specimens which have appeared in any publication, and this note is inserted, in justice to the author of an invention, which will probably be of considerable importance."

We should be much gratified, should it suit the inventor's views, to receive a description of his mode of procedure, as, should it abridge the labour, it will often be preferred even where wood engravings can be procured, and will be of extensive utility. We have made some essays of the kind, but found the labour too great, and, when executed, the effect was very inferior to some of those produced by Mr. Jackson.

List of Patents granted in the United States, from March 23d to April 10th, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

In the method of pumping water out of Ships by manual power; Thomas Brownell, N. York, March 23.

In an improved cooking stove; Joseph R. Page, Philadelphia, March 24.

In a machine for pressing, and for lifting, heavy bodies; Samuel Andrews, Bridgetown, Cumberland county, Maine, March 24.

In the twin plough; Noble G. Cryer, Wentworth, Rockingham county, N. Carolina, March 24.

In the churn; S. L. Bagley, Hillsdale, Columbia county, N. York, March 24.

In the method of grinding and polishing hard substances; Benjamin Green, Windsor county, Vermont, March 27.

In the horse rake; Jeremiah Baily, Philadelphia, March 30.

In the manufacture of tobacco; John Allen, Jr. and Charles Geoghegan, Richmond, Virginia, April 3.

In making watch keys; John S. Davis, Providence, Rhode Island, April 3.

In cutting wood into a circular form for the sides of tubs, buckets, &c.; Jeremiah Baily, Philadelphia, April 7.

In the machine for grinding apples; Constant H. Wicks, Paris, Oneida county, New York, April 9.

In making hominy; Robert Campbell, Martinsburg, Virginia, April 9.

In the paddle wheel of a steam boat; Robert L. Stephens, Hoboken, New Jersey, April 10.

French Patents granted in the third quarter of 1826.

A. Poussard, Toulouse, for an addition to the quadrature of a clock —15 years.

M. Bailly, Paris, for a process wherewith every individual may take himself the measure of his coats—5 years.

N. H. Manicler, London, for a substance to manufacture wax candles—15 years.

V. M. Fichet, Estrepilly, for a machine to cleanse corn—5 years.

F. Lacarriere, Paris, for a regulator in the emission of gas—5 years.

Viscount de Barras du Molard, Valence, for a new system of bridges—5 years.

A. E. Jauge, Paris, for additions to the apparatus for extracting salt from liquid—15 years.

A. N. Lhomond, Paris, for additions to his chimneys called "Parisienne"—15 years.

Anspach and Valentin, Metz, for an oil-mill—15 years.

O. Napier, London, for a system of canal locks—10 years.

G. Busnoir, Lyons, for new gallooks—5 years.

J. Collier, Paris, for a power-loom, with intermittent motion—15years.

M. Lorillard, Nuits, for a machine to prepare flax or hemp—15 years.

Joh. Knoules, London, for a new system of constructing masts —10 years.

P. Revon, Paris, for additions to a locomotive carriage engine—10 years.

Hue, Paris, for making picture-borders—5 years.

J. Lenobbe, Paris, for a wool-combing machine—5 years.

S. Vallee, Paris, for manufacturing cotton twist, called "cordonnet-cotton"—10 years.

L. C. F. Coninck, Paris, for a new process of creating steam--15 years.

A. Bouchet-Viors, Montpellier, for a distilling apparatus--10 years.

Frimot, Landernau, for a rotative steam-engine—15 years.

D. Levique, Alencon, for improvements in piston guns—5 years.

L. F. Dorrielle, Pellusin, for a substance as a substitute for the gall-nut—15 years.

L. Richard, Paris, for a process to propel boats up a river—15 years.

Joanne Freres, Dijon, for a machine to carry boats up a river by its own current—15 years.

V. Mouton, Paris, for manufacturing bars, &c. covered with metal —5 years.

Granted in the last quarter of 1826.

Stock, Samuel, Paris, for a process to print or paint on both sides of silks, cottons, &c.—10 years.

J. B. P. Nichols, Paris, for an apparatus to cool beer—10 years.

P. J. Debezis, Paris, for a distilling apparatus—10 years.

J. A. Cambaceres, Paris, for the use of Stenric acids, in the fabrication of oxygenated wax lights—15 years.

S. Frank, Amsterdam, for a blacking called the *cordova lustre*—5 years.

Messrs. Lemoine and Meurice, Paris, for a machine for mixing colours—15 years.

Allnand, Brothers, Limoges, for a method of grinding by water, to reduce into an impalpable powder, and convert into paste or enamel, all flinty, earthy, and other metallic oxyde substances—10 years.

R. M. Joly, Paris, for water-proof boots and shoes—5 years.

F. P. Lebourlier, Paris, for a method of taking off the husk of black pepper, and whitening it—5 years.

J. Laborde, Paris, for a mechanical apparatus for evaporating, concentrating, thickening and clarifying liquids, or all liquified substances—5 years.

C. E. M. Bereche, Paris, for a lighter steam-boat than those hitherto built—15 years.

A. B. Gensoule, Bagnols, for a method of heating the pans, for winding off silk from the balls, with economy of fuel—10 years.

S. Berard, and J. Wilkinson, for a bobbin and its carriage for spinning, lengthening, and twisting raw silk, flax, hemp, wool, cotton, and such like—15 years.

P. Arnut, Rochefort, for an economical chimney, free from smoking, and for a machine for sweeping chimneys—5 years.

A. Rivaux, Lyon, for a weaver's shuttle, in which the cane experiences a retrograde motion every time it is thrown, by which the portion of woof over-wound, returns upon the cane—5 years.

L. D. Davenne, Paris, for a moveable cushion for billiard tables—15 years.

P. Masnyac, Lyon, for a method of preparing hats with chickens' feathers—5 years.

LIST OF PATENTS IN ENGLAND.

Which passed the Great Seal, from March 2d, to March 27th, 1827.

To Joseph Frederick Ledsam, of Birmingham, merchant, for his having invented an improvement for purifying coal gas, by means not hitherto used for that purpose—Sealed 2nd March.

To Nathan Lucas, and Henry Ewbank, of London, merchants, for their having invented an improved process to be used in the dressing of paddy, or rough rice—10th March.

To Lemuel Wellman Wright, of Surrey, engineer, for his having invented certain improvements in the combination and arrangement of machinery for making metal screws—17th March.

To Benjamin Rotch, of Furnival's Inn, in the city of London, esq. for his having invented a diagonal press, for transferring perpendicular to lateral pressure—22nd March.

To James Stewart, county of Middlesex, piano-forte maker, for his having invented certain improvements on piano-fortes, and the mode of stringing the same—22nd March.

To James Woodman, of Piccadilly, perfumer, for his having invented improvements on shaving and other brushes, which improvements are also applicable to other purposes—22nd March.

To Jacob Perkins, of Fleet street, in the city of London, engineer, for his having invented certain improvements in the construction of steam engines—22nd March.

To Matthew Bush, of Dalnonach Print Field, near Bonhill, near Dunbarton, North Britain, calico-printer; for certain improvements in machinery, or apparatus for printing calico, and other fabrics—March 27, 1827.

NOTICES.

To Correspondents.—Mr. Malin's furnace, and Mr. Stott's coal-boats, will appear in our next, as the lost drawings have been recovered, and the cuts are completed.

Essays on Lithography.—We are compelled to issue the present number without a continuance of this series of essays, in consequence of the *Journal des Connaissances*, not having yet come to hand. They will undoubtedly be resumed in our October number.

Erratum—In Mr. Shaw's paper on gunpowder, in our last number, p. 129, 15th line from the bottom, for 'less *durable* than formerly,' read 'less *desirable* than formerly.'

Mr. Perkins's Engine.—Some very satisfactory information on the subject of this engine, came to hand after our last form was made up: this will appear in our next, and we hope that an expected communication from Mr. Perkins himself may also arrive in time to accompany it.

Subscribers in New York are particularly requested to pay the amount of their subscriptions to Mr. James M. Campbell, No. 9 Arcade, who continues to be the agent for this Journal. A part of the numbers for August, were delivered by a friend to the publisher, during the period of the temporary interruption of Mr. Campbell's business, in consequence of the dissolution of his partnership with Mr. Hart. Should any unfavourable impression have been made by this circumstance, it is hoped that the present notice will suffice for its removal.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

OCTOBER, 1827.

Description of a furnace for smelting Iron, by means of Anthracite.

By JOSHUA MALIN, *Engineer.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,

I have the pleasure of sending you a plan of a furnace for smelting iron ore with anthracite. I have been under the necessity of finishing the drawing rather hastily, but hope, however, that it will be found to be sufficiently descriptive. You will perceive that in its construction, it is, in general, similar to the common blast furnace; the crucible, and hearth alone, differing materially. The crucibles of these furnaces, both American and English, are square; but in this, it is round, and it must necessarily approach this form when anthracite is to be used; this coal is so much more dense than either coke, or charcoal, that its weight causes it to descend in the corners, or angles, of a square hearth, where, being screened from the intense blast which is required, and carrying with it a portion of the unmelted ore, it mixes with, and chills a quantity of the fused ore, and metal, and stops the operation of the furnace.

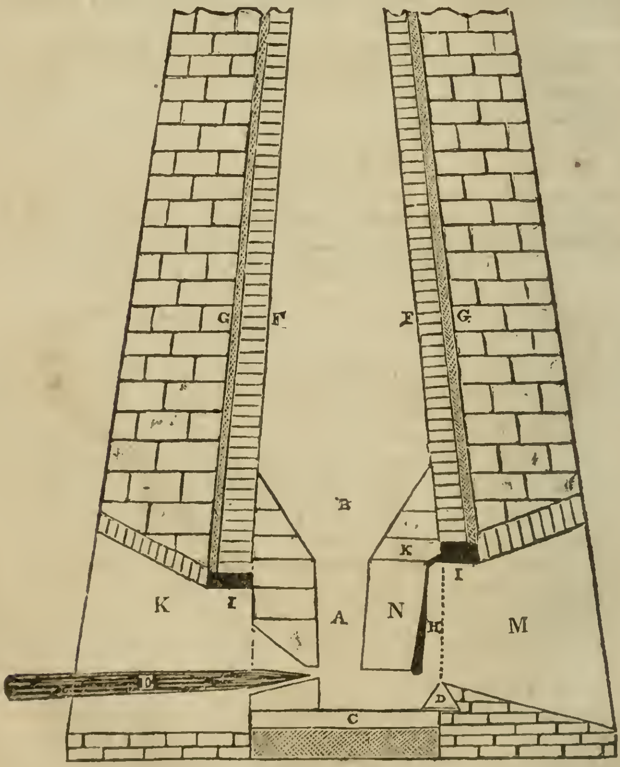
For the smelting by means of anthracite, the blast must be introduced under a pressure of, at least, two and a half pounds to the circular inch; and the quantity required for a common sized furnace, will not be less than twenty-eight hundred cubic feet, per minute; or seven cubic feet per minute, for every circular inch in the area of the hearth, at the tuyere. Common sized hearths are about 20 inches in diameter; $20\times20=400\times7=2800$ feet; this, I think, will be found to be a good proportion.

The hearth of the cupola, or furnace, in which I tried many of my experiments, was only eleven inches in diameter, at the tuyeres; the blast being introduced as represented in the accompanying plan: I increased the diameter to fourteen inches, and found that the blast which I had at my command, would not enable me to go beyond this point, as, when I attempted it, the scoria, and metal, chilled, and formed a tube from the tuyere, a part of the way across the hearth.

An elliptical hearth will undoubtedly answer, by introducing the blast, with the tuyeres placed opposite to each other, at each end of the oval; I am of opinion, however, that the circular form will be found to be the best.

Joshua Malin.

Lebanon, Pa., May 24th, 1827.



The letters of reference exhibit the same parts both in the horizontal, and vertical sections, when they are found in both. The figures are drawn to a scale of an eighth of an inch to the foot.

A, The crucible, being a part of what is commonly called the hearth of the furnace.

B, The boshes, or part where the metal passes from the solid to the fluid state, as it descends.

C, The bottom stone of the hearth, bedded on sand, and supporting the crucible, and boshes; these are made of the best stone for standing fire. Whenever the hearth requires to be renewed, this stone, together with those forming the crucible, and boshes, have to be removed, the rest of the stack remaining permanent.

D, The dam-stone, supported on the outside by brick work, on which rests a cast iron plate, kept covered with coal dust, on which the scoria flows down.

EE, The pipes by which the blast is introduced.

FF, The in-walls of the furnace, made of fire-brick, or of sandstone, but preferably of the former.

G, A space, from 4 to 6 inches wide, filled with soft sandstone, broken fine, to allow of expansion, and contraction.

H, The tymp-plate, of cast iron, to support the tymp stone.

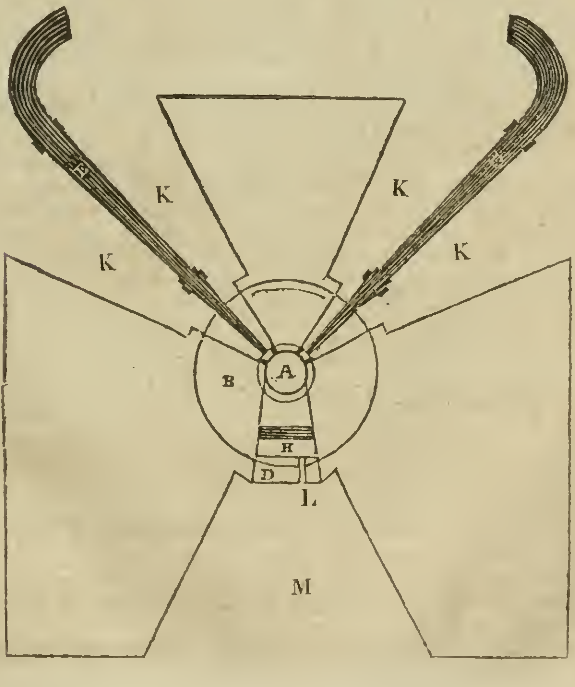
II, Cast iron lintels to support the in-walls over the tuyere, and tymp arches.

KK, The tuyere arches.

L, The part where the metal flows out.

M, The tymp arch. (This in Mr. Strickland's reports, is called the lymp arch, but the common name with us, is tymp arch.)

N, The tymp stone, forming a part of the crucible, and supporting a part of the boshes.



Essay on Earthenware and Porcelain.

[From Parkes' Chemical Essays.]

(*Continued from page* 152.).

Nothing is found to answer so well for making the potter's moulds as plaster of Paris; because, when rightly prepared, it has the property of absorbing the water so very rapidly from the ware, that it occasions it to slip out of the mould, or to *deliver* itself easily, as the technical phrase is.

To prepare the plaster for making the moulds, it is first ground in a mill exactly similar to that which is generally used for grinding corn by means of a pair of flour stones; it is then baked, or rather boiled,* to expel the water, which is one of its component parts when in a native state.

This plaster, which is the native sulphate of lime, is boiled in very long brick troughs, having a fire flue running underneath them. The man who superintends the process, has a handkerchief tied over his mouth for safety; as the small particles getting upon the lungs, or into the stomach, have been found to be very injurious to the health of the operator.

When this plaster has been thus deprived of water, it is in the state of a soft and impalpable powder; and if its own proportion of water be again mixed with it, it will immediately set into a hard compact mass. It is this property which renders it so peculiarly fit for making the potter's moulds.

The manipulations by which the different articles of earthenware are made, are so various and multiplied, that it would be very difficult, if not impossible, to describe them. They can be known only by those who have had opportunities of visiting a pottery. A short outline of these processes will, however, be expected from me, and may be acceptable to the generality of my readers.

Much of the common earthenware is formed by means of the potter's wheel, which is a round board attached to a lathe, and capable of being moved thereby, either rapidly or otherwise, as the occasion may require. This round board moves in a horizontal position; and when in use, the clay which is to be fashioned is fixed on the centre of it; and it is put in motion either by a person who constantly attends it when at work, or by means of a treadle which is moved by the foot of the workman himself.

As the clay revolves upon this machine, the workman either models it by his fingers, or forms it, by means of an instrument which he holds in his hand, into any kind of circular shape that he may desire; and when the object is to make a number of vessels exactly similar to each other, the size is generally determined by a guage fixed without the circumference of the revolving wheel, but projecting over it in such a manner, that, whenever the yielding clay is spread out until it touch this guage, the artist knows that the article which he is making has attained the exact figure which he intends.

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* *Boiled.* This may appear to be an incongruous expression when applied to a dry earthy substance; but the fact is, that when the ground plaster is heated it has so much the appearance of ebullition, that the term which I have employed is made use of by the workmen universally. The finished article is always called *boiled plaster.*

The potter's wheel is probably the most ancient of the manufacturing instruments now in use. It was known to the author of that book in the Jewish Scriptures, which claims the highest antiquity of any writings we have, and who must have lived at least 3000 years ago. This simple instrument has, however, of late years been much improved by adapting a strap to it, which passes over a large taper cylinder of wood, by means of which the artist is enabled to increase or diminish the rapidity of the motion at pleasure. This contrivance is known to mechanics by the name of the *cone pulley*.

In going through a pottery, it will be observed, that all the articles are very thick and coarse when they come from the wheel. This perhaps is unavoidable. They are therefore taken to a lathe, where the extra quantity of clay is removed, in the same manner as the wood-turner forms his work by shaving off successive portions of the wood. These parings of clay are afterwards kneaded as before, and then worked over again for similar purposes.

It is curious to notice the great variety of circular things that may thus be made by means of the potter's wheel; but it must be remembered that this machine is calculated only for cylindrical, conical, or round articles, and not for such as are of an oval or an irregular form. All such are made in plaster moulds, which divide in halves for the convenience of taking out the ware whenever it is found to be sufficiently dry to be removed. The handles of cups and jugs are also made in moulds, and these are afterwards put on the vessels for which they were designed.

The consumption of sulphate of lime, gypsum, or alabaster, (for this substance is known by these various names,) is so considerable for making the moulds for plates and dishes, that in the course of the year many tons of worn out moulds are thrown away as useless. I would suggest, that these might be ground and used as manure, instead of purchasing fresh gypsum for that purpose.

As the plaster moulds absorb water with avidity, the articles which are made in them dry much sooner than would generally be imagined. For instance, the moulds on which the common table-plates are formed, are put into a very temperate stove as the plates are made, and in about two hours the whole will be dry enough to be removed to make room for a fresh parcel. In the usual way of conducting a manufactory, every mould is capable of taking four or five fresh plates in the course of a day of twelve hours. The plate-stove is generally a very small room built with bricks, and shelved with boards from the floor to the ceiling. It is usually heated by an iron pipe which passes through it.

When the plates are removed from this stove, they are taken off the moulds, and pared round the edges with a small knife; and when they have been slightly polished by the hand, they are laid by to become hard enough for the biscuit oven.

From this short account it may be easily conceived that a common-sized pottery must require a great deal of room, especially as every article, whether made by the wheel, the lathe, or the moulds, must be spread out upon shelves to dry: and this reminds me of an expedient which I lately observed at the works of an ingenious potter in Staffordshire, and which I conceive to be so far an improvement upon the old practice, as to deserve being mentioned, and which I have the leave of the proprietor to make public.

The improvement to which I refer, is that of having a chamber shelved entirely round, not with stones or boards as is usual, but with shelves of prepared plaster made as smooth as polished marble, and of the thickness of an inch and a half each.

Upon these plaster shelves, instead of those of wood and stone as commonly adopted at other works, the goods are placed to dry: and the great advantage which must accrue to the manufacturer from the practice is very obvious; for the plaster not only absorbs the water sooner, but the articles will dry more regularly and uniformly than they possibly can when placed upon substances which cannot abstract the water. Being persuaded of the utility of this expedient, I have no hesitation in recommending it for general imitation. Moreover, why may not the floors of a potter's warehouses be covered with plaster? The expense would be very inconsiderable, and then, whenever these were not in use for storing the finished ware, they might be advantageously employed in hastening the drying of the goods newly made.

In some countries it is usual to form the floors of cheese chambers with plaster, and I have been told that the cheese becomes sooner ripe on these floors than on others; though Mr. Twamley directs that it should not be placed on plaster until time has been allowed for the first moisture to exude and evaporate.*

An important improvement might be made in the manufacture of earthenware, if it were possible to contrive an expeditious mode of spreading the goods out so as they might always dry gradually. The property which clay has of contracting by heat or by drying, is well known, and the excellence of earthenware depends in a great measure on its being very *gradually* dried before it be exposed to the kiln.

When the articles of pottery have been modelled or fashioned to the design of the artist by any of the foregoing methods, and have been partially dried, either by an exposure to the action of the atmosphere, or by placing them for a certain time in stoves or drying rooms constructed for the purpose, they are carried to the potter's oven, where they are placed in deep, oval boxes, made of fire clay. These are called *seggars;* and being flat at bottom, one of these vessels forms a cover for another, so that the workmen are enabled, without difficulty, to place them in piles nearly to the top of the oven, which is a large building of brick, in the form of a cone, and very similar to a common glass-house.

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* Josiah Twamley *On Dairying*, 8vo. Warwick, 1784, p. 100.

When the oven is properly filled, heat is applied by means of ignited coal, which is thrown into several receptacles built on the outside, but communicating by means of flues, with the inner part. These are called *mouths;* they stand about four feet in height from the ground, and project about three feet from the sides of the kiln.

In the beginning, the heat is kept at a low state; but after a lapse of twelve hours it is gradually increased, and the augmentation of temperature is continued until the kiln, and its contents, acquire the proper maximum.

An attention to the degree of baking is an object of extreme importance. Vauquelin has remarked that "the heat should be such as to expel the moisture, and agglutinate the parts which enter into the composition of the paste; but incapable of effecting the fusion, which, if too far advanced, will render the ware of so homogeneous a texture as to become brittle."*

It has been found that alumina loses 0.46 of its weight even when the fire is not urged beyond the temperature of ignition for silver; whence it appears that it contains nearly half its weight of water, and it does not part with the last portion, but with great difficulty.

The operation of burning usually lasts two days and two nights. This, however, varies in the different charges; and the fireman judges when the ware is sufficiently burnt, by examining the trial pieces which are placed in those parts of the oven where they may be taken out with ease, and without causing any diminution of the heat.

These trial pieces are made of the common red clay, of the Staffordshire brick-makers. It is found in the Potteries, and has the property of changing its colour at every change of temperature: therefore, by comparing one of these, taken out of each part of the oven, with a trial piece made of the same kind of clay and properly burnt, and which is kept on purpose for a standard, the state of the ware under operation, may, at any time, be exactly known.

All the common ware undergoes two firings: that is, when it has been sufficiently dried in the air, it is put into an oven and made into what is called *biscuit*, which is earthenware partially burnt.

Many ladies are in the habit of buying china in the state of biscuit, for the purpose of painting and gilding. When they have imparted their own designs, these are sometimes returned to the potter, who burnishes the gold and completes the baking. This is mentioned with the view of directing those females who may not be already acquainted with it, to a new object for the exercise of their taste and genius, and also for the better explanation of the nature of biscuit ware.

All the English earthenware and china undergoes this previous firing, because, were it not first made into *biscuit*, it would not bear to be immersed in the mixture of lead and water, called the glaze, without suffering injury thereby: that is, it would not fail to be rendered soft, and liable to be put out of form, by its absorption of the water. Neither would it sustain the process of printing, nor allow of its being painted upon with any good effect.

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* Vauquelin's *Reflections on the Qualities of Pottery*, communicated to the Philomathic Society at Paris.

The composition of the Chinese porcelain is different, and its nature is now pretty accurately known. Mr. John Bradley Blake, who was settled as a resident supercargo at Canton, and died there at the age of 29, sent, a short time before his death, to Mr. Samuel Moore, the then Secretary to the Society for the Promotion of the Arts, specimens of the earths, clay, sand, stones, and other materials used in making the true Nankin porcelain, all which Mr. Moore put into the hands of the late Mr. Wedgwood, who from these materials produced some pieces of excellent porcelain, and declared that those earths were so complete a set of specimens, that he had no doubt of their being the true materials of the Oriental porcelain. Had Mr. Blake lived, further information would have been procured.

It was ascertained by Mr. Blake, and we have learnt from other sources, that, in China, the earthenware and porcelain are merely dried in the air before glazing; as their composition so effectually resists water, that it can be immersed in an aqueous glaze, without being first made into biscuit, and consequently that the Chinese are enabled to burn their ware by one single firing.

It is therefore a desideratum with the potters of this country, to find some substance to mix with the clay which shall give it the property of resisting the action of water before it has undergone the first burning. This would be a great acquisition to our English manufacturers, because it would not only be a saving of fuel, but a great economy of time and of the expense of wages, as one operation would be thereby entirely saved.

Dr. Woodward mentions the Soap Rock at the Lizard Point, and the steatites in other places, as very likely to make good porcelain. Dr. Campbell also, who seems to understand this subject, strongly recommends this article to be employed in the manufacture of china. Whether steatites will improve the body of the ware, as above mentioned, I do not know, but I know it has been used at some of our porcelain works in considerable quantities.

Should the English potter be able to make the body of his ware equal to that of the East, it would then be necessary, as I apprehend, to discover some other material for the glaze; because, if our ware were burnt, as it is in China, by one operation, the earth would contract more than the glaze, and consequently the latter must either crack, or partially fly off.

I hazard this opinion, because I know that in China the glaze is infinitely better than ours, inasmuch as it consists purely of fel-spar, and is so extremely hard that it cannot be operated upon by any of our common cutting instruments. Even the wheel of the glassgrinder will not touch it; whereas ours becomes scratched and defaced, by common usage and ordinary wear.*

If the glaze on porcelain be too thick, this will occasion it to break; it is therefore important to apply a thin glaze, the fusibility of which should be as nearly as possible approaching to that of the body of the ware, in order that the combination may be more intimate and lasting. Chaptal, describes a glaze which perhaps our potters may imitate with advantage. "It consists," says he, "in mixing the earth of Murviel in water, and dipping the pottery therein. When dry, they are plunged into a second water, in which levigated green glass is mixed. This covering of vitreous powder fuses with the clay of Murviel, and the result is a very smooth, very white, and very cheap glazing."

The great durability of the Oriental china is its main excellence. We make porcelain in this country which is equally beautiful; and, if the symmetry of the figures and the merit of the painting be considered, far more elegant, although it possesses a less degree of tenacity and hardness.† We have, indeed, lately noticed the introduction of what is called stone-china, which is made very thick and clumsy to imitate some of the best productions of the East: the glaze upon this, however, is as poor and soft as upon other English china.

Is it not natural then to ask, Why do not our potters make use of a better glaze,‡ especially as the county of Cornwall can furnish felspar in abundance and at a reasonable price?

The true answer to this question seems to be this; that our ovens are not capable of fusing a glaze similar to that which is employed in China.§ The heat of the potter's oven in that country must be tremendous. The materials could not be vitrified as we see them, with less heat than would fuse Cornish granite.

An ingenious mode of discovering when the glaze on china is not sufficiently hard, has been given by the late Mr. Nicholson. It consists in dropping a small quantity of strong ink upon it, drying this before the fire, and then washing it. If the glaze be too soft, an indelible brown stain will remain upon it.

It must here be remarked, that for those who choose to incur the expense, there is porcelain manufactured in some parts of this kingdom, which is more durable than that commonly made in the Staffordshire potteries. Such was formerly the Bow china, and that also made at Chelsea; and I have been credibly informed, the china now manufactured at Worcester is nearly equal to the best Dresden, or to the true Nankin, in all those properties which give the most value to this production of art.

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* This remark is not applicable to all the European porcelain; for that made in Saxony, and in some other parts of Germany, is equal to the best Oriental china.

† It is probable that the heaviest and most compact china will always prove to be the most durable. Dr. Watson, in taking the specific gravity of several specimens of pottery, found that a cubic foot of cream-coloured ware weighed 1988 ounces avoirdupois; of flint ware, 2188 ounces; of Bristol stone ware, 2340 ounces; and of the East Indian china, 2346 ounces.

‡ In the year 1803, Professor Proust, of Madrid, published some remarks on the glazes of pottery. See his paper in the *Journal de Physique*, under the title of "A Memoir on tinning Copper Vessels." Extracts from this production will be found in the *Philosophical Magazine*, vol. xxi. p. 313.

§ The fusibility of the earthy compounds depends upon their proportions. Lime and clay are, separately, infusible; but, in due proportions, the mixture is capable of forming a perfect glass.

It is worthy of observation, that while the king of Prussia was pursuing every possible method of advancing and extending the manufactory at Berlin,* the works at Worcester continued to improve year after year, without patronage, and that they were brought to their present perfection solely by the genius and enterprise of the proprietors.

Of late years, a porcelain manufactory of considerable consequence has been established at Coalport, in the county of Salop. Some peculiar kinds of china, both serviceable and beautiful, are produced at these works.

The common heat of the potter's kiln in England is about 60° of Wedgwood's pyrometer,† which is equal to 8877 degrees of Fahrenheit, for the cheapest cream-coloured ware, and about 80° of Wedgwood for the Staffordshire porcelain; though I have reason to believe that the manufacturers of the best cream-coloured ware, seldom allow the heat of the kiln to exceed 45° of Wedgwood's pyrometer. It must be recollected, however, that we fire twice, and that these heats refer to what are employed in converting the ware into what is called biscuit.

I am not myself acquainted with the respective temperatures at which the other porcelain manufacturers fire their ware; but Dr. Henry has stated, that the Worcester china vitrifies at 94, that the Chelsea porcelain is fired at 105, and the Derby at 112 of Wedgwood.

In the Staffordshire potteries the temperature of the gloss-oven is generally about 10° of Wedgwood, or 2377 degrees less of Fahrenheit than the heat of the biscuit oven. The reason of this is, that there may never be any danger of the ware, in this last operation, undergoing a higher degree of heat than it experienced in the first burning; it being absolutely necessary for the operator to be careful of this point, because, as clay will continue to contract by every addition of heat, it must follow, that should it ever be pushed beyond that degree which it sustained in the state of biscuit, the body of the ware would experience a greater contraction, and consequently every piece within the oven would either become crooked, or the glaze would be injured. The firing of the gloss-oven generally requires from 12 to 14 hours.

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* In order to encourage this manufactory, and make its productions more generally known, the king made presents of complete services of the Dresden porcelain to all the sovereign princes in Germany.

† For an account of the construction of Wedgwood's pyrometer, the reader is referred to the 72d and several of the subsequent volumes of the *Philosophical Transactions*, or to Murray's *System of Chemistry*, vol. i. p. 150.

The glazing for the common cream-coloured earthenware consists usually of certain portions of litharge and ground flints, mixed with as much water as will form them to the consistence of thin cream, which is found to be a state the most suitable for the immersion of the ware. One hundred pounds of litharge, and 40 pounds of ground flints, are the common proportions; but it is usual to take 80 pounds of Cornish granite to 100 pounds of litharge, whenever that is used instead of flints. Flint is the article which is employed in making glaze for the porcelain, as well as for the coarse earthenware, it being nearly all silica. Klaproth found common flint to consist of ignited silica 98 parts, lime 0.50, alumina 0.25, ignited oxide of iron 0.25 parts, volatile in the fire 1.

For the finer kinds of earthenware, and for porcelain, it is made with white lead, ground flint glass, ground silica, and common salt. Some manufacturers, however, add other materials; most of those who superintend this department imagining that they possess a valuable secret, and that in consequence of it their glaze is much better or cheaper than that of others.

In all manufactories it is found necessary to vary the composition of the glaze, according to the nature of the materials which form the body of the ware; and the former cannot be perfect unless it be capable of contracting and expanding by heat and cold, in the same proportion as the ware itself will contract or expand by the change of temperature. The writer of the article *Porcelain* in the French Chemical Dictionary very properly remarks that "a glass which makes a fine glazing for one porcelain will make a very bad glazing for another sort of porcelain, will crack in many places, and have no lustre. The glazing must be appropriated to the density of the ware and the ingredients of its composition."

[TO BE CONTINUED.]

NATURAL HISTORY.

THE BEAVER.

(Concluded.)

Fabulous History of the Beaver.[*]

THIS part of our subject is richer in materials than any other which comes within the scope of our work. We have in the beginning adverted to the grand source of error in this and other departments of natural history, but there is one circumstance peculiar to the history of the beaver, which has thrown over it more delusion than in the case of almost any other animal. The fur traders, Indian interpreters, and Indians themselves, have furnished the greater part of the information which we possess of the habits and manners of this animal. To these persons the beaver is a most important object, and regarded with a degree of admiration and superstition exactly proportioned to their ignorance. Hence they have in numerous instances been led to magnify facts actually observed, and to state their own notions of the sagacity of the animal, as realities, not intending to deceive, although they have deceived themselves. To become acquainted with the peculiarities of a species both nocturnal and exceedingly timid and vigilant, requires years of patient and assiduous attention. It is not surprising, therefore, that persons seeking information should resort to those who are devoted to the pursuit of the animal, and receive their statements, given with seriousness and minute detail, as worthy of credit. In addition to the errors which spring from the ignorance of these observers, there is a worse evil to which inquirers are exposed. The traders, hunters, and interpreters have, for various reasons, considerable jealousy of all those who are too inquisitive about their peculiar concerns, and it is an occurrence of almost daily repetition, that when they are questioned on these subjects, they take a malicious pleasure in palming, with truly Indian gravity and patience, the most false and marvellous relations upon their auditor.

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[*] We have selected, from Dr. Godman's Natural History, about one third part of this division of the subject, as the whole would have demanded more space than we could afford. Those who wish to see more of the *poetry* of Natural History, are referred to the original work. [EDITOR.

As the reader is already in possession of all the well-attested facts to be procured in illustration of its habits and character, we may safely present a few of the marvellous relations which have been heretofore given of the beaver, leaving him to separate the great mass of fiction from the few truths with which they may be mingled. We therefore begin with the most ancient of these fictions, and come down to the latest writers who have contributed to the perpetuation of such erroneous views.

"The castor, or beaver, when in the rivers, feeds upon shell-fish and such other prey as it can catch. This variety of food is the reason why its hinder parts, to the ribs, have the taste of fish, and that they are eaten upon fast days, and all the rest has the taste of flesh, so that it is not used at other times.

"It has pretty large teeth; the under, standing out beyond their lips, about three fingers breadth; the upper, about half a finger, being very broad, crooked, strong and sharp, growing double, very deep in their mouths, bending circular, like the edge of an axe, and are of a yellowish red. They take fishes upon them as if they were hooks, being able to break in pieces the hardest bones. When he bites he never loses his hold until his teeth meet together. The bristles about their mouths are as hard as horns; their bones are solid and without marrow; their fore feet are like a dog's, and their hinder, like a swan's. Their tail is covered over with scales, being, like a soal, about six inches broad and ten inches long, which he uses as a rudder to steer with, when he swims to catch fish; and though his teeth are so terrible, yet when men have seized his tail they can govern the animal as they please.

"The beavers make themselves houses of square timber, which they gnaw down with their teeth, almost as even as if they were sawed, and almost as equal as if it were measured. They lay these pieces across, and each is let down by large notches into the other, so that, having dug a hole for their foundation, they build several stories, that they may rise higher or lower, according to the fall of water."*

"Amongst the beavers some are accounted masters, some servants. They are cleanly in their houses; for the making of which, they draw the timber on the belly of their ancients, they lying on their backs."†

"They have a chief or superintendent in their works, who directs the whole. The utmost attention is paid to him by the whole community. Every individual has his task allotted, which they undertake with the utmost alacrity. The overseer gives a signal, by a certain number of smart slaps with his tail, expressive of his orders. The moment the artificers hear it they hasten to the place thus pointed out, and perform the allotted labour, whether it is to carry wood, or draw the clay, or repair any accidental breach. They have also their sentinels, who, by the same kind of signal, give notice of any apprehended danger. They are said to have a sort of slavish beaver among them (analagous to the drone) which they employ in servile works and domestic drudgery."‡

"Sometimes a single beaver lives by itself, and is then called a *hermit* or *terrier*. Whatever may have been the cause which has separated these individuals from society, it is certain that they always have a black mark on the inside of the skin upon their backs, which is called a saddle, and distinguishes them from the others. Cartwright supposes this separation from society may arise from their fidelity and constancy to each other, and that, having by some accident lost their mate, they will not readily pair again. He thinks, likewise, that the mark on the back may proceed from the want of a companion to keep that part warm."‖

"Three beavers were seen cutting down a large cotton-wood tree: when they had made considerable progress one of them retired to a short distance and took his station in the water, looking steadfastly at the top of the tree. As soon as he perceived the top of the tree begin to move towards its fall, he gave notice of the danger to his companions, who were still at work, gnawing at its base, by slapping his tail upon the surface of the water, and they immediately ran from the tree out of harm's way."§

"The Indians have related to me, in a positive manner, another trait of these animals, but it is so extraordinary that I leave you at liberty to believe or reject it. They assert, and there are some who profess to have been ocular witnesses, that the two chiefs of two belligerent tribes, sometimes terminate the quarrel by single combat, in the presence of the two hostile armies, like the people of *Mediéve*, or three against three, like the Horatii and Curiatii of antiquity. Beavers marry, and death alone separates them. They punish infidelity in the females severely, even with death.

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* Pomet, Hist. of Drugs.

† Lemery.

‡ Pennant's Arctic Zoology, p. 117. vol. i.

‖ Church, Cab. Quad. Bachelors of the human species have good cause to rejoice that their backs are clothed, if Captain Cartwright's doctrine holds good throughout, otherwise their forlorn condition would be at once indicated by something like the aforesaid *saddle*.

§ Long's Expedition to the Rocky Mountains, vol. i. p. 464. It is but just

"In fine, these animals are so extraordinary, even in the eyes of the Indians themselves, that they suppose them men, become beavers by transmigration, and they think in killing them to do them a great service, for they say they restore them to their original state."*

We may advantageously conclude the fabulous history of the beaver, by introducing the judicious observations made on the subject by Hearne, whose excellent remarks on this animal have been, hitherto, altogether overlooked.

"I cannot refrain from smiling when I read the accounts of different authors who have written on the economy of these animals, as there seems to be a contest between them who shall most exceed in fiction. But the compiler of the Wonders of Nature and Art, seems in my opinion to have succeeded best in this respect, as he has not only collected all the fictions into which other writers on this subject have run, but has so greatly improved on them, that little remains to be added to his account of the beaver, besides a vocabulary of their language, a code of their laws, and a sketch of their religion, to make it the most complete natural history of that animal which can possibly be offered to the public.

"There cannot be a greater imposition, or indeed a grosser insult on common understanding, than the wish to make us believe the stories of some of the works ascribed to the beaver; and though it is not to be supposed that the compiler of a general work can be intimately acquainted with every subject of which it may be necessary to treat, yet a very moderate share of understanding would be sufficient to guard him against giving credit to such marvellous tales, however smoothly they may be told, or however boldly they may be asserted, by the romancing traveller."†

Description of the Beaver.

The beaver is about two feet in length, having a thick and heavy body, especially at its hinder part. The head is compressed and somewhat arched at the front, the upper part being rather narrow, and the snout, at the extremity, quite so; the neck is very short and thick. The eyes are situated rather high up on the head, and have rounded pupils; the ears are short, elliptical, and almost entirely concealed by the fur. The whole skin is covered with two sorts of hair; one which is long, rather stiff, elastic, and of a gray colour for

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to state that this is given, in that work, as a "*hunter's story*," which is too often synonymous with an English word of three letters.

* Beltrami; La Decouverte des Sources du Mississippi, &c. 1825.

† Octavo ed. 1796, p. 231.

two-thirds of its length next the base, and terminated by shining, reddish, brown points, giving the general colour to the pelage; the other is short, very fine, thick, tufted and soft, being of different shades of silver gray or light lead colour. On the head and feet the hair is shorter than elsewhere. The tail, which is ten or eleven inches long, is covered with hair similar to that of the back, for about one-third of its length nearest the base, the rest of it is covered by hexagonal scales, which are not imbricated.

The only species of beaver, known, is the one we have described; all the others which have been noticed, are varieties of this species.

During the first year of their lives, the beavers are termed pappooses, by the hunters; when two years old, small meddlers; at three years of age, large meddlers; in their fourth year they are called beavers, and after that, old, or great beavers.

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. V.—*Processes followed in Bleaching.*

SECTION II.

2. *Bucking.*—This is one of the processes which has lately received important improvements from the invention of an apparatus called the whale boiler, whose operation has already been described. But whether this be used, (and it is not yet general,) or the old apparatus, the goods are treated precisely in the same way, and it is a very important part of the whole operations. The first thing to be attended to in bucking is the preparation of an alkaline ley of a proper strength. For this purpose the crude alkali is to be broken into small pieces not exceeding the bigness of a hazel nut, or bruised by means of a horse mill, and put into the boiler with a proper quantity of water. It would be an economizing of fuel to put this into the boiler immediately on drawing off old leys, when the heat of the boiler and its fire place, supposing a small quantity of the fire to remain, the registers of the furnace being shut up and the boiler covered, will be sufficient to melt the alkali in the course of the night. The liquor ought not to be permitted to boil, for Dr. Home, (p. 103,) proves by experiment that salts from ashes by boiling are not so strongly alkaline as the ashes themselves. If pearl ashes are added to a ley made from the other crude alkalies, they need not be put in till the solution is nearly completed, as their greater quantity of carbonic acid renders them much easier to dissolve. Those who pursue the older modes of bleaching, put the goods into the alkaline solution which is thus prepared; but as its strength can be, according to Kirwan's experiments, increased one-half by the addition of so cheap an article as quick-lime, this ought never to be neglected, particularly also as chemistry informs us, that no alkali will combine with any oleaginous matter (unless it be in a state of causticity). It

is of great importance to attend to this when American pearl ash is used, as it always contains a large proportion of carbonic acid. Des Charmes advises to take of quick-lime the whitest which can be had, a third or a fourth part in weight of the solution, and heat up in a bag or cloth to prevent it from rendering the ley turbid. A better method is to add one part of well-burned fresh-slaked and finely pulverized quick-lime, to two parts of the alkali dissolved as above. When the lime has been added, the mixture is to be brought to boil, taking care to keep it in constant agitation with an iron rake, to prevent the lime from subsiding, and fixing on the bottom of the boiler. When the ebullition has commenced, it will produce sufficient agitation to keep the lime suspended. The boiling may be continued for two hours, when the lime may be allowed to subside and the clear supernatant liquor, now in a state of causticity from the loss of its carbonic acid, may be run off for use. The lime which has subsided is to be washed with water till it comes off clear without alkaline taste, and the washings are to be kept for making fresh leys. The bleachers ignorant of chemistry, erroneously imagine that the lime imparts some of its properties to the ley, but as the precipitated lime is found to be a carbonate, it clearly appears that it has by superior affinity abstracted the acid from the carbonated alkali. Des Charmes says that it is not necessary to add lime to American and Russian ashes, as they contain a large proportion of it when imported, but he surely forgot that this lime is commonly in the state of a carbonate, and therefore cannot take up the carbonic acid which renders the ashes mild.

I have stated, that in rendering alkalies, caustic quick-lime is to be added in the proportion of two to one by weight, but this is somewhat vague, and will not apply where there is much difference of quality in the alkalies. It will consequently be of importance to ascertain some test by which to determine when a proper quantity of lime has been used. For this purpose, when the boiling of the mixture has been stopped, take a little of the supernatant liquor in a wine glass, and breathe into it through a small glass tube, or add to it a few drops of clear solution of subcarbonate of pot-ash; if there be a redundancy of lime, the dissolved earth will absorb the carbonic acid from the human breath, or from the pot-ash, and will render the liquor turbid. If it does not become turbid, add a little lime-water, and if this occasions turbidness, it shows, that the liquor contained carbonated alkali, and has not had a sufficient quantity of lime. If the lime be in due proportion, the ley will neither show turbidness from these tests nor will it effervesce with acids.

It is of the greatest importance to the bleacher to be able to determine readily, the specific gravity of his leys, as they must be used as nearly as possible, of the usual strength: ley of 1.0127, or 1.0156 specific gravity is what is commonly employed. To ascertain this, the hydrometer is generally used. A new instrument of this sort was, some time ago, proposed by Professor Leslie, (Ph. Mag. XVI. 200,) but I have not heard whether it has ever come into use. It was to be constructed on the principle which he has fully demonstrated—that capillary attraction is nothing more than the specific relative attraction of solids and fluids, and the purity of the liquid examined, would be indicated by its ascent in a capillary tube graduated with enamel colours. The instrument in common use is not so simple, nor so elegant. Those which were formerly employed were not constructed on a fixed principle, so that when one of them was broken, another could not be made to the same scale. This inconvenience, however, has been removed by the ingenuity of Mr. Tweedale of Glasgow, whose hydrometers are now universally used. The method which he adopts is to commence the scale at 1, and to make every degree indicate .005 of specific gravity. Hence, supposing the alkaline ley to indicate 20° on the scale, its specific gravity would be $1.+20\times.005=1.100$, the specific gravity of water being unity. A complete series of these numbers from 1 to 6, indicates the specific gravity of fluids; from distilled water, as 0. to sulphuric acid, 2. the heaviest liquid known. In using such instruments it is necessary to attend to the temperature of the atmosphere, as all bodies are greatly influenced by their sensible caloric, and their bulk increased or diminished according to the quantity which they contain. In water, the fifth decimal figure changes with every degree of Fahrenheit's thermometer, other fluids observe different rates. Some bleachers guess at the strength of their leys by the taste, but this must, at best, be an uncertain criterion. Des Charmes tells us that the laundresses of France ascertain the quality of leys from their lubricity when rubbed between the finger and thumb, or from the readiness with which they absorb the colouring matter of the goods.

When leys are made caustic by means of quick-lime, and drawn off for use, they will commonly be of the same strength at the top and bottom of the vessel; but when they are not removed from the boiler, and the goods are put in as soon as the solution has been effected, the liquor will be often three-fourths stronger at the bottom, than at the top, from the undissolved alkali continuing to melt. This ought to be carefully attended to, as it is contrary to the general law which obtains in solutions, namely, that they are of equal strength throughout. Dr. Home supposes the anomaly to depend on the presence of lime in a state of mechanical mixture.

It is of importance that the ley should be always as clear and limpid as possible, for if the lime remain either in solution or suspension in the smallest proportion, it is apt to be precipitated into the fabric of the cloth, and will be fixed by the sulphuric acid sour, which will produce an insoluble selenite. This, however, is not of so much consequence for the two or three first immersions, as it is when the goods have once acquired an even colour, and require only to be brightened. It is then essential for the saving of time and labour, to have them as colourless as possible.

Des Charmes directs the goods to be put into the bucking apparatus in a moist state; Dr. Home, that they should be dry, in order, he says, "that the salts may enter into the body of the cloth, along with the water, as they will not enter in such quantity if it be wet, and by acting too powerfully on the external threads may endanger them." The Doctor's reasoning appears to me perfectly just.

The goods which have been treated as already directed, are placed in the kieve in open folds, as in the steeping process, and a quantity of the caustic ley (heated to the temperature of the blood), is poured over them, sufficient for their thorough immersion. The heat is increased, very gradually, till it reach the boiling point, when it is thrown up against the umbrella, and spread, by it, over the surface of the goods, through which it percolates into the boiler again, and so on in succession till it be saturated with impurities. This is known from its losing its causticity, and acquiring an offensive smell, or from the deepness of the colour both of the ley and the cloth. The success of the process indeed is commonly estimated in proportion to the deepness of the colour, which the cloth has acquired. (Home, p. 72.) Particular attention ought to be given to the gradual increase of temperature now directed. For the resinous or oleaginous colouring matter of the cloth, the twisting of the threads, and closeness of texture, must hinder the liquid from penetrating it, particularly at first, so that if the ley were poured on at 212° the cloth might be liable in several parts to a dry heat. This is usually illustrated by the general effects which heat produces on coloured vegetable matter. Thus if any vegetable is to be softened, or to have its juices extracted, it is found that this can be better done by beginning with moderate degrees of heat, than by plunging it all at once in boiling water, which would rather harden it and fix its colours. Cooks are well aware of this, and always when they wish to preserve the green colour of vegetables after boiling, never put them in till the water has acquired its highest temperature. The same reasoning applies to the process of bucking: and here also it is confirmed by experience, as goods which have unfortunately been put into boiling ley in the first instance, can never be brought to a good white. Dr. Home is so much impressed with the importance of this, that he deems it adviseable to keep the ley under the boiling point for the two first buckings; but this is surely carrying the precaution too far.

Des Charmes' method excluded boiling as unnecessary, it being sufficient, he thinks, that the ley be hot and sufficiently abundant. He takes out his goods when the liquid under the cover in the middle of the heap is too hot to admit of the hand being held in it, or when it simmers round the circumference of the boiler, and throws up white bubbles, which circulate towards the centre. Frequently he only plunged the goods, for a few minutes, into ley of a very gentle heat, and he found that by this treatment, both cotton and piece goods, bleached perfectly well.

The leys, when the above circumstances are indicated, are to be drawn off, and warm water poured over the cloth in the kieve, which by combining with part of the remaining impurities which have been loosened, serves to carry them off. When this has been done, a stream of cold water is allowed to play on the goods till it run off nearly limpid, after which they are taken to the dash wheel; the reason for this process, which is not always properly attended to, is, that were the cloth carried from the kieve to the dash wheel, while hot, a certain portion of the colouring matter would be again fixed in it, which would not easily be again removed.

The process of bucking is successively repeated, even as often as 10 times, before the operations are finished, and with leys of different strength. I find that with respect to the variation of the strength of the leys, there are two modes recommended, directly opposed to one another. Des Charmes says it is adviseable to keep the leys at the same degree of force, during the first two or three immersions of the same goods, *diminishing the strength one third or one fourth*, as soon as the pieces have acquired a uniform colour. In this period, weaker leys may be advantageously used, because there remains scarcely any thing more of impurity to be carried off; and the subsequent process may be considered merely as a brightening of the colour by detaching the small portion of impurity which may remain fixed in the texture of the thread, (p. 81.) With this, agree the experiments of Mr. Roe and of Bings, (Report on Experiments, &c. Dublin, 1791.) The practice of our bleachers in Scotland and Ireland is directly the reverse of this. They use the weakest leys at the commencement, and increase them in strength as they proceed. Dr. Home's reasoning on this seems to be conclusive. "The leys," he says, "should be weakest in the first buckings, because then they act only on the more external parts, but when the cloth is more opened, and the field of action increased, the chemical agent ought likewise to be invigorated," (p. 61—2.) This argument, and the uniform practice of our most enlightened bleachers, should, I think, clearly determine this point.

In repeating the bucking process, most bleachers occasionally use leys which have formerly been used for a similar purpose, even more than once. This practice we have already reprobated, when treating of steeping, and in the present case it is of no less importance to avoid it, particularly in bucking fine goods. They seem to have been led to this bad practice from its apparent economy, but when it is considered that it is only the unsaturated portion which can act, pure ley must evidently be cheaper. Besides, cloth bucked with foul ley, becomes heavier instead of lighter, and consequently must receive impurity from it. Des Charmes directs a mixture to be made of foul with new ley, adding a third or fourth of the latter; but these added portions of fresh ley must be greatly impaired in strength, by taking up the impurities with which the old ley is loaded, and this is found to agree with experience. It is of some consequence to remark, that little advantage can arise from several buckings, *immediately* succeeding one another: even the second immersion in the ley will frequently leave it quite limpid. Des Charmes found it of more advantage to use the ley rendered caustic by lime at the commencement of the buckings than afterwards, when it might impair the texture of the goods.

SECTION III.

3. *Washing.*—It is never to be forgotten, that between each of the several processes, of steeping, bucking, souring, &c., the goods are to be thoroughly washed by the dash wheel in pure water, so that all the loosened impurities, as well as the detergent which has been employed, may be effectually removed. When any of these are left through defect of washing, they not only prevent the proper operation of the agents afterwards supplied, but often leave in the cloth indelible stains. Besides, as it may, through neglect, become dry after bucking or souring, the salts will be condensed in proportion to the dryness of the cloth, and acting with greater force will destroy its texture. Soap is not employed except in the first washings and in finishing. Black, or soft soap is found to be the best for these purposes, brown soap leaving a yellowish tinge on the cloth. If these precautions are not attended to, the goods which are imperfectly washed will be in danger of becoming yellow instead of white, by immersion in preparations of chlorine; and even of acquiring a tenacious and disagreeably ruddy tinge, either partially, if the washing has been partial, or totally, if it has been entirely neglected. The bleacher should be on his guard, not to soap cleared goods in the soapy solution which has been used for pieces taken out of a strong chlorine preparation, even though they have first passed through a sour of sulphuric acid; for this soapy solution does not fail to acquire the property of discolouring other goods, unless the goods which were soaped, after being taken out from the chlorine preparation, have been immersed for a long time in clear water. Washing should always if possible be performed *immediately* after bucking, while the goods are yet warm, as the filth and refuse will then be easier removed than after they become cold.

4. *Crofting, or exposure on the Field.*—It has been accounted a great desideratum in bleaching to find a method of finishing goods without exposing them on the bleach-green, as it consumes a great deal of time and labour, and keeps out of cultivation large tracts of good arable land. It was thought, at one time, that the introduction of chlorine bleaching, would supersede crofting; and it would do so, in a great measure, were it practicable to apply it in a proper manner. But, however great may be its facility in bleaching, it is scarcely possible to adopt it in an extensive manufactory to the exclusion of crofting, without very heavy charges in work-shops and apparatus. This naturally follows from what has already been remarked with regard to finishing the bucking process; and it is useful to take notice of it. as bleachers often let their goods lie in heaps for a considerable time before washing. The washing of goods after souring, is sometimes admitted on the erroneous notion that the acid which adheres to the cloth, is useful in giving activity to the oxymuriatic salts. Evils of which they are unaware, arise from this mode of management; for when the sulphuric acid thus left in the cloth, meets with lime, it forms a sulphate, which becomes fixed in the pores of the cloth, and produces stains that crofting cannot remove.

The prevalence of this may be seen by examining the kiers which are often covered on the inside with this pernicious sulphate; it can therefore only be economically adopted with such goods as are intended to receive what is called a half, or three-quarter white. It has certainly very much diminished the period which crofting was wont to require, and in this seems to consist the chief difference between the old and the new modes of bleaching.

The first thing which claims attention, is the soil and situation of the bleach-green. A gravelly or sandy soil seems to be the best, as the water will pass quickly through a soil of this kind, and will increase the reflection of the heat, for the process depends on the evaporation which may thus be caused. For the same reason it ought to have a southern exposure, and if possible should rather be sloping than level. To prevent the water becoming muddy it should run in a channel paved with sand-stone.

When the cloth has been steeped and bucked, it is spread out on the field, and frequently watered for the first six hours, to prevent the condensation of any alkali which the washing may not have removed. Dry spots are then allowed to appear before any additional watering. Dr. Home thinks that it profits most by this exposure when near drying, as the evaporating particles come rather from the more internal parts, than the surface; and that it is chiefly evaporation which operates, is inferred from the fact, that the upper, is uniformly whiter than the under surface. That it loses together with its grayish tinge the remainder of the acids and alkalies, with which it has been treated, appears from the safety with which it may be afterwards dried. Soap when sliced down and exposed to the sun and air, with frequent waterings, will lose half its weight in a fortnight; the inference is obvious and need not be stated. From some experiments it appears that the sulphur of the leys is one of the substances which is evaporated in crofting, and we know that this always has a tendency to produce a yellow tinge. (See Trans. R. T. Acad. III. p. 45.) Berthollet seems to have taken a view of this process not quite so scientific as might have been expected, when he tells us (Ann. de Chim. II.) that crofting only prepares the colouring particles for being afterwards dissolved and separated by the ley. He surely never had observed the peasants bleach, by crofting alone, or by crofting *after* boiling in alkaline or soap leys.

It is supposed by bleachers, that exposure on the field has more effect in the months of March, April, and May, than in any of the other months. As this idea is universal, it is likely well-founded, although Dr. Home has endeavoured to account for it by the greater attention which is usually paid to goods at the beginning of the bleaching season. He states also that Mr. Christie, an experienced and enlightened bleacher, found the summer and autumnal months to be more efficacious than those of spring. But may not the drought prevalent in March, produce such an effect, if evaporation is the agent? And if light, as seems indubitable, is requisite, will not the want of clouds at this time be of consequence? The effect of light on colours is often very striking. When I was in Ireland, I observed that the bed curtains in the rooms of Shane's castle, which are exposed to the reflection of light from loch Neagh, were changed from fast and brilliant colours, to pure white. Baume (Journ. de Physique 1793) found that yellow raw silk, loses its colour in a short time, by exposure to the sun, (see a memoir on this subject, Ann. de Chim. VI. 80.) Berthollet imagined that there might be something in dew, which was efficacious in crofting, and he accordingly examined the dews which fell at different periods of the night. He found them (Ann. de Chim. II.) so strongly impregnated with the principle of acidity, that they reddened paper tinged with turnsole. From this he accounts for the greater efficiency of spring dews, on the erroneous doctrines that dew is transpired from plants, and that plants transpire oxygen and dew most copiously in spring. That the sun has a considerable effect in whitening, independent of evaporation, appears from this, that in dry windy weather the evaporation is more speedy, but the bleaching is slower than in calm sunshine, which seems to be the best weather for crofting. Dr. Home thinks however that in consequence of the slowness of the evaporation, the moisture comes more from the internal parts of the goods; this he thinks must be the case, in consequence of the heat tending to open the pores, while the wind will rather close them. The same intelligent chemist remarks, that it is in consequence of its completing the bucking process, by evaporating the salts which are combined with the loosening impurities, that crofting proves beneficial; no sort of washing which he tried as a substitute, was found capable of superseding the process; crofting always follows every bucking and boiling. There are, strictly speaking, two modes of crofting: the goods are artificially watered from troughs or little canals; or, they are exposed to all the vicissitudes of the atmosphere, without artificial watering. The latter is called dry crofting.

5. *Boiling.*—Coarse linen cannot afford the time and labour, but particularly the quantities of alkali, necessary for bucking, and must undergo the shorter and more active operation of boiling. Although, however, it may seem to be the more active process, it by no means follows that it is the most efficacious; on the contrary, the ley is much thicker and darker after bucking, than after boiling. As the heat continues longer at the degree of boiling, the leys used for the coarse cloth must be weaker than those used for the fine. There is not so much danger from heat in the coarse as in the fine cloth, because the former is of a more open texture and will allow the ley to penetrate more speedily; but in coarse cloths of a more close texture, the heat should be raised gradually to the boiling point. The effect of boiling raw cotton or linen in a diluted solution of caustic alkali, is to give the liquor a deep brown colour and to destroy its causticity; and fresh portions of clear ley applied a second or third time will produce similar effects, but in an inferior degree. (Rees' Cycl. Bleaching.)

In bleaching fine goods, boiling is among the finishing operations, and is only employed when the goods are nearly white, in order to remove the disagreeable smell of the preparations. The ley in this case is composed of pearl ashes, or of pearl ashes and white soap. The boiling ought not to be urged with a brisk fire, but kept barely at the boiling point. The goods must be completely covered with the ley, and kept from rising by a cross similar to that used in steeping, in order that they may be exposed equally to the action of the alkali or soap. In bleaching fine cottons, such as lawn grounds, books, and light jaconets, no pearl ashes are used, the ley being made wholly of soap.

6. *Immersion in the preparations of Chlorine.*—When the oxymuriates of lime, potash, soda, or magnesia have been prepared in the way already directed, they are to be diluted to the specific gravity of 1005, or 6 or 8 quarts of the solutions may be mixed with 20 gallons of water, and put into the immersing apparatus of Rupp or any other which may be thought best. The test liquors already so fully described are then to be had recourse to, to check the indication of the specific gravity. Mr. Dalton's certainly seems to be the best, but where this is not at hand, solutions of indigo, cochineal, or turnsole, may be used; even red wine is no despicable test, when the others cannot be had. It may be useful to take notice of the several colours which these test liquors acquire when the chlorine preparations are of sufficient strength. Dalton's tests have already been copiously explained. The indigo test becomes yellowish, passing into wood, and of a deeper or fainter tint, in proportion to the darkness of the blues; the tincture of cochineal, becomes Dutch orange; red-wine becomes wine yellow; and infusion of turnsole, becomes amber brown. The goods are to be immersed in the liquor immediately on being removed from the bleach-green, and particular care ought to be taken that they be all equally exposed to its action, otherwise stains and spots may be produced, which subsequent treatment may not be able to remove. Twelve hours is the usual period allotted for the immersion of linens; but less time will sometimes be sufficient. The bleaching liquors, according to Mr. Roe's experiments, may be repeatedly used without detriment, till their whole strength be exhausted. *(Dublin Report,* 1791.)

MR. PERKINS'S NEW STEAM ENGINE.

We are anxious to satisfy public curiosity, which has been considerably excited by what we have already published, on the subject of Mr. Perkins's new steam engine. The letter addressed to us by that gentleman, promised a specification with drawings, and enquiries have been repeatedly made, whether these had arrived: but as the enrolment of his last patent in England, which embraces his recent improvements, was not to take place until September, we apprehend that at least a month must yet elapse, before the expected papers arrive; we however publish, from the London journals, such information as they contain, and are particularly pleased with having it in our power to present some engravings which will suffice to give a very clear idea of the general structure of the engine, but more especially of the manner in which his generator is arranged. The two next articles, with the accompanying figures, are copied from the "Register of Arts and Science," a work very ably edited by L. Hebert, engineer; a new series of which has just commenced, under the title of "Register of the Arts, and Journal of Patent Inventions."

Mr. Christopher Davy, the writer of the second article, has published another communication on the same subject, in No. 200 of the London "Mechanics' Magazine," with a drawing representing a very elegant arrangement of the parts of the engine; but as it does not afford any additional information with regard to its structure, its republication is unnecessary; we will, however, offer a few remarks upon the observations of the editor, which accompany Mr. Davy's communication.

Those persons who have attended to the subject, are aware that in the earlier efforts of Mr. Perkins, he used a generator which was a single vessel, of great strength, surrounded by the fuel, and kept constantly filled with water, by means of a forcing pump; this was so highly heated, that the portion of water which was expelled from it at every stroke of the engine, immediately flashed into steam. In the use of this generator, many difficulties were experienced, which it is unnecessary to recount; and it now appears that he has substituted a series of tubes, which, he believes, have obviated all these difficulties. The editor of the Mechanics' Magazine thus notices this subject. "The chief novelty for which Mr. P. formerly claimed credit, was the generation of steam from water, confined by mechanical pressure, within a strong cylinder, till it became so hot, that a drop of it, on being forcibly ejected, would instantly flash into steam. But now Mr. P. injects the water, while cold, into a series of small tubes enclosed within a furnace, and heated as much as possible; from which tubes it is transmitted, in the shape of steam, to the working cylinder. It would appear, therefore, that Mr. P. has now abandoned all hope of realizing a working engine on his original plan, and has betaken himself to a mode of construction, in which he has the misfortune to be preceded by several, not unsuccessful competitors. Eve's engine, and Babcock's, which was successfully applied in America, to the propulsion of boats, about a year ago, are both like this of Mr. Perkins, on the tubular plan; so also are those of M'Kirdy and Gurney, which have been the subject of recent patents."

On reading the above quotation, any one might be inclined to believe that Mr. Perkins had abandoned his original idea of substituting pressure, for surface; or, in other words, of keeping his generator filled with water, at a temperature of several hundred degrees, by the aid of a powerful forcing pump, so that its free caloric should be sufficient to convert it into steam, instantaneously, when a portion of it was forced out. Several of our friends in this city, had drawn the conclusion that this abandonment had actually occurred; but, by a careful attention to the description of the action of the generator in its present form, they will perceive that the same principle still prevails. Tubular boilers, in various forms, have been repeatedly essayed, and that long before the particular modifications, proposed by the gentlemen named, were presented to the public. The merits of the respective plans we are not disposed to discuss, but wish merely to point out the essential difference between the whole of them, and that of Mr. Perkins; which difference, it appears, has been frequently overlooked. We have said that his is kept filled with water; the others are heated, for the purpose of converting into steam, the water which is injected into them; in his, there is no steam, the others are filled with steam. The lower tier of tubes in Mr. Perkins's generator, may be considered as a part of his steam chamber.

From "The London Journal of Arts and Sciences," and from the "Technological Repository," we have taken the account of the first comparative trial of Mr. Perkins's engine, which appears highly favourable. The great and interesting question of its relative value, must soon be decided; and if but one half of the anticipations of the inventor are realized, his improvements will confer benefits upon the public, second only to those bestowed on the world by the immortal Watt.

We, in common with most of our friends, had been so long kept on tip-toe, looking for the fulfilment of promises repeatedly made, that we had nearly ceased to expect their performance; but "success is omnipotent," and should this equal the genius, and the perseverance of our countryman, we shall then be ready to express our surprise, at the obstacles which he has surmounted, and at the wonders which he has achieved, in the course of a few short years. May such be his triumph!

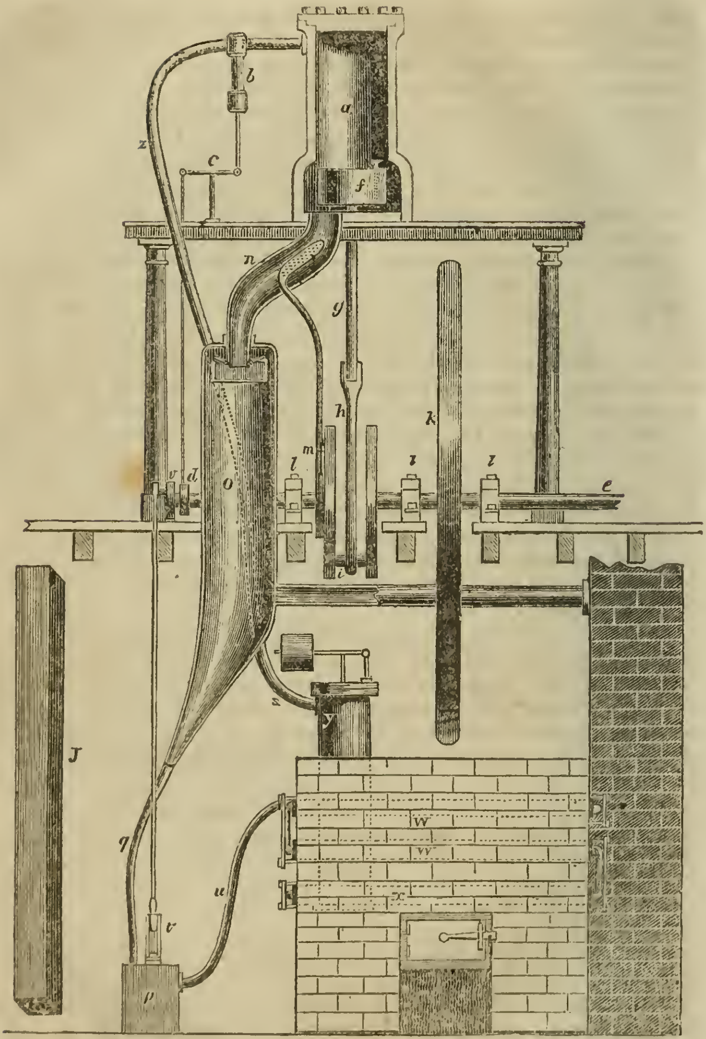
Should Mr. Perkins fail, he will fail in good company. Sir Humphrey Davy, and Dr. Wollaston, who occupy the most exalted stations in the temple of science, have countenanced his efforts, during his whole career; and with such support, it would argue no common degree of hardihood and temerity, to speak of his projects as chimerical, or even of a failure, as less honourable than a successful retreat.

A brief Description of Mr. Perkins's new "High Pressure Safety Engine."

To the Editor of the Register of the Arts and Sciences.

SIR,

Presuming that a brief description of Mr. Perkins's New "High Pressure Safety Engine," may, in the absence of a more amplified and particular account, be acceptable to your readers, I venture to send you the enclosed. It has been drawn up, perhaps, with too little regard to the arrangement and construction of the subordinate parts; but to have done full justice to the genius of the inventor in these respects, several drawings would have been necessary, and a more detailed description. I am anxious, therefore, that it should be clearly understood, that I only profess to give a correct account of the principle and mode of action of the engine, and with that intention the accompanying diagram, (see the ensuing engraving) is contrived to show the whole operation at one view.



Reference to the Engraving.—*a* is the working cylinder, supplied with steam by the valve *b;* this valve, by means of an intermediate lever *c*, is operated upon by the revolution of the cam *d*, on the main shaft *e*. *f* is the piston, *g* the piston rod, *h* the connecting rod to the crank *i; l l l* bearings in which the shaft turns; *m* is an eccentric, which works a valve placed in the injection tube, leading into the condenser *u;* the lower extremity of the condenser is formed into a box, having two valves, opening outwards into the expansion vessel *o*, to which a pipe, *q*, is connected, leading into the hot well *p;* in this is placed a force-pump *t*, worked by a rod attached to the crank *v*, which forces the condensed water (temperature about 100°) through the pipe *u*, into the generators *w w*, fixed across the furnace, and through the opposite walls: *x* is a lower and third tier of pipes, similar to the others, but employed to allow the water from the former to expand into steam, after it has acquired sufficient power to overcome the pressure of a heavily loaded valve. From the pipes *x*, the steam passes into the large vertical chamber *y*, and from thence, at regular intervals, along the pipe *z*, into the working cylinder. The separate figure J, shows one of the pipes, of the generator, the same as those, at *w* and *x*, in perspective.

From the foregoing, it will have been noticed that this engine has only what is termed a single action, the steam being admitted on one side of the piston only; and that *the principle* of heating water in very strong vessels, under a high state of pressure, as in Mr. Perkins's former patent, is still adhered to. The pipes for heating the water, *w w*, and those for allowing it to expand into steam, *x*, are formed of cast iron bars, five inches square, with a perforation throughout their length, of 1½ inch in diameter. These are arranged in three horizontal tiers over the furnace, in such manner that the heat shall act successively, and as uniformly as possible, upon their surfaces: they are connected at their extremities, so as to form one continuous vessel, by bent tubes screwed into their orifices, which are further secured by bolts and flanches, as represented in the diagram. The two uppermost rows are kept filled with water, at a very high temperature, under a heavily loaded valve, which communicates with the lowermost tier of tubes; into these the heated water is injected, (at every stroke of the pump) and instantly flashes into steam; the steam thus formed, has to pass, successively, through every pipe in the lowermost range, exposed to the strongest action of the fire; from the last of them it enters, by a short tube, the large vertical chamber *y*, for the supply of the engine.

The internal diameter of the principal portion of the cylinder is about eight inches,* but the lower end is enlarged into a cylindrical chamber of nine or ten inches in diameter, and about six inches deep, for the reception of the piston at the end of the stroke, which takes a range of about 20 inches. The steam is admitted into the top of the cylinder at a pressure of 800 lbs. upon the square inch, and when the piston has descended through one eighth of the length of the cylinder, the supply is cut off, so that the remainder of the stroke is effected solely by the expansion of the steam; when the piston has reached the bottom, or enlarged part of the cylinder, the steam rushes past it through the condenser into the expansion vessel, when the whole of it expands to the atmospheric pressure: the valves at the lower part of the condenser (before mentioned), now close by their own gravity, at which instant a spray of water is injected into the condenser, by which the remaining steam is condensed; and nearly a perfect vacuum effected. The water thus reproduced, is blown into the expansion vessel, along with the steam, at the next down-stroke of the piston; the water running down into the hot well, to be returned to the generators by the action of the force-pump, while the steam escapes by a lateral tube into the chimney of the furnace. The upward, or return, stroke of the piston, is effected by the momentum given to the fly-wheel; and to prevent any resistance to the ascent of the piston, which might be caused by condensed steam above it, there is a small valve in the piston, which is opened when the latter reaches the bottom of the cylinder; therefore, whatever uncondensed steam may remain in the cylinder above the piston, has free passage through the latter to the underside, thus occasioning no obstacle to its ascent. At the termination of the upward stroke of the piston, this little valve is closed, in like manner, by striking against the top of the cylinder, so that the next charge of steam introduced into the cylinder, may not be diminished in its effect.

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* That at present on Mr. Perkins's premises in Water Lane, Fleet Street, which is at work, and open to public inspection every Saturday.

The piston employed is of the metallic kind, and consists of several expanding rings, formed of a *peculiar alloy*, which Mr. Perkins states he has found to require neither oil, tallow, nor any lubricating material whatever, to reduce the friction; on the contrary, by the working of the engine, the rubbing surfaces of the piston and cylinder become so highly polished, as to reduce the friction considerably below that of the ordinary metallic packing when oiled. Thus Mr. Perkins has obviated one of the principal difficulties he had to contend with, namely, that of the oil or grease becoming carbonized, when working with steam of such high temperatures as he employs.

Among the advantages resulting from these novel arrangements, the ingenious patentee calculates that he saves full half the fuel usually employed; that by the mode of condensing the steam, he effects as perfect a vacuum as in Boulton and Watts's condensing engines, with a great saving in the consumption of water, and without the necessity of, or the friction attending, an air-pump.

Some exception has been taken to Mr. Perkins's mode of showing the power of his engine by a weighted lever resting on the upper edge of the periphery of his fly-wheel, a method involving so much uncertainty that I cannot believe it possible a man of Mr. Perkins's great talents can propose it as a correct test, but only as a convenient means of subjecting the engine to considerable labour by way of proving its power to a certain extent.

Your constant reader,

M. K.

[Since the foregoing was prepared for the press, we have been favoured with some excellent drawings of Mr. Perkins's New Engine and Generating Apparatus, made by Mr. Davy, from actual measurement; consequently embracing all the details in their true proportions, many of which are highly ingenious and interesting.

[*Editor of the Register of the Arts.*

A Description of Mr. Perkins's Engine; with Drawings, exhibiting its elevation, a section of the furnace and generators, and the structure of some other important parts. By Christopher Davy, *Teacher of Architectural Drawing, London.*

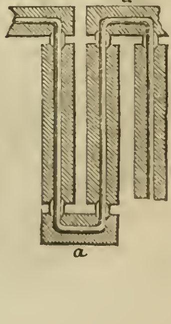
To the Editor.

Sir,

From the important nature of Mr. Perkins's improvements in steam apparatus, I feel assured that there needs no apology for bringing the subject of his "High-pressure safety Engine" again under the notice of your readers; and I cannot do better than preface this description by quoting the concluding remarks contained in the last lecture on the steam engine, delivered by the learned and worthy president of the London Mechanics' Institution.—"Important as many of these stupendous machines are, and great as have been our achievements through their agency, it must be confessed, that with respect to the nature of steam, the construction of steam engines, and their application to the service of man, we are, as yet, but on the threshold of our knowledge. * * * *—There is yet, I can confidently assure you, ample room for the exercise of your inventive powers."

Every candid person will, I think, freely admit that the great talents of Mr. Perkins, seconded as they are by uncommon energy and activity, have enabled him to make more rapid strides towards attaining those great benefits which Dr. Birkbeck has so eloquently described, than any other individual of the present day; for he has constructed an engine of unrivalled portability, and brought highly-elastic steam under perfect control; and, as a consequence, rendered it perfectly safe to employ its vast powers to any extent that may be deemed desirable.

I shall now proceed to describe the inclosed drawings,—and first refer the reader to fig. 2, which represents a longitudinal section of the furnace and steam generators. The latter consist of bars of cast iron 5 inches square, and lying horizontally in the furnace; each of these have a hole cast through them of 1½ inch diameter, they also have communications with each other in the front and rear of the furnace, where they are so connected as to allow the water to be forced through each of the upper tiers, previously to its being flashed into steam in the lower tier. The connexions are formed, as shown by the diagram in the margin, which represents a sectional plan, exhibiting the before-mentioned connecting pipes, herein marked *a a;* these parts are entirely inclosed within the furnace, and are fastened by flanches on the outside, so that should the pipes become loosened, they may be fastened by the adjusting screws of the flanches, which draw them firmly into contact with each other, as I will presently more particularly describe. By the operation of a forcing pump, connected to, and worked by, the engine, the water is injected into the



ELEVATION OF PERKINS'S NEW "HIGH PRESSURE SAFETY ENGINE."

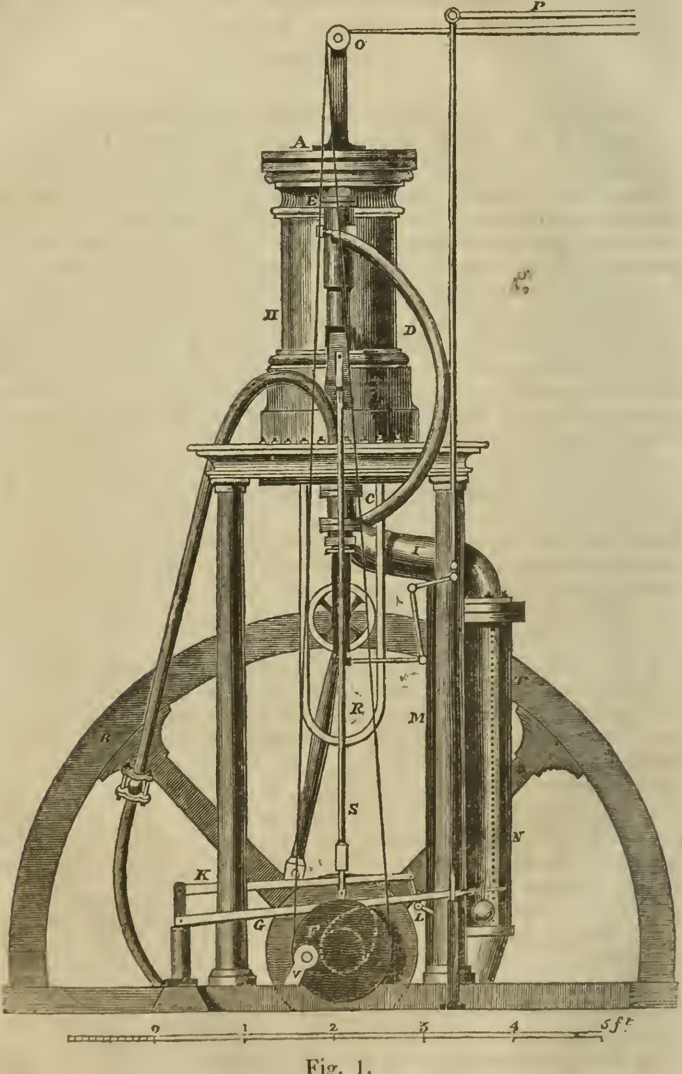
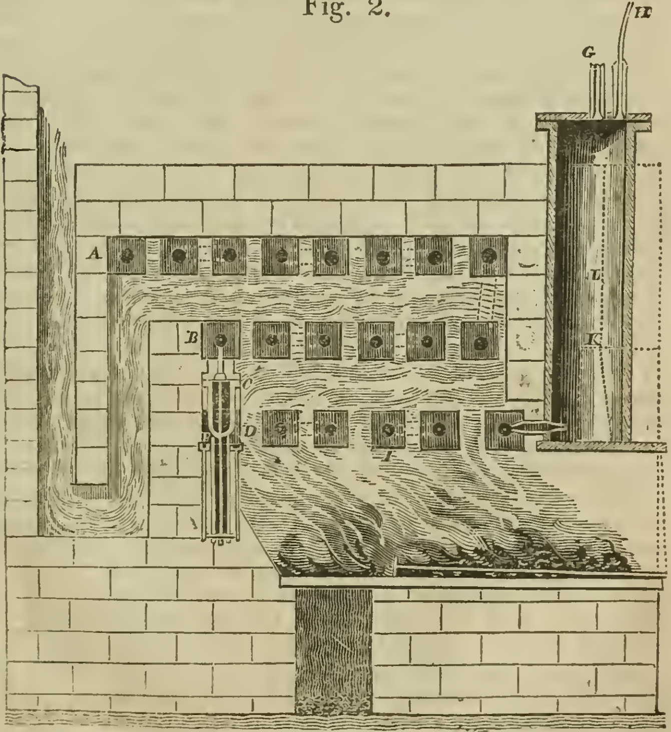


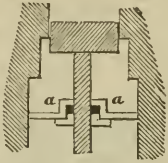
Fig. 1.

two upper tiers of tubes, marked A and B, (fig. 2,) wherein the water is raised, and kept up to a temperature of between 7 and 800° Fah. The lower tier, I, is kept at a heat of about 1000 Fah. so that at every stroke of the engine a certain quantity of water is displaced from the upper tiers, and discharged from the pipe B into the valve box C, which opening downwards is received into the lower tier of tubes, and instantly flashes into steam; from thence it rushes into the steam chamber L, and the valve C is replaced in its seat by the agency of a weighted lever; the notches F show the fulcrum of the same. G is a loaded valve, to relieve the pressure in the steam chamber, should it become overcharged with steam; H is the pipe which conveys the steam to the working cylinder, (the continuation of this pipe is shown at B, fig. 1); at K is an opening in front of the furnace, to supply the same with fuel.

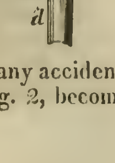
Fig. 2.



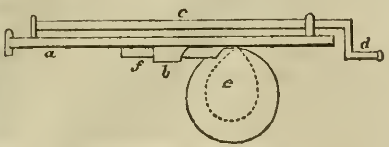
The steam being now generated at a pressure of 800 lbs. on the square inch, it passes through the pipe B, fig. 1, enters the pipe D at C, and from thence enters the working cylinder A at E. The steam has apparently no sooner entered the cylinder, than by the action of the rod S, which is fixed to the lever G, and acted upon by the cam F, (dotted) it is shut off, the piston having then only performed one-eighth part of its stroke of 20 inches; the steam by its own expansion drives the piston downwards, and when at H, where there is an enlargement of the cylinder, the steam is reduced to 100 lbs. upon the inch, occupies the space *a a*, and from thence is conveyed to the condenser I. The lower extremity of which, T, is furnished with a box, and two valves opening outwards, which valves close by their own weight, when the steam has expanded to the common atmospheric pressure: the lever K now performs its office, which being worked by a cam, the cock L is turned, by which movement a jet of water is thrown up the pipe N into the condenser I; and the steam therein is thereby converted into water, and nearly a perfect vacuum effected. The water from the valve box runs down into the hot well, and by the forcing pump is re-conducted into the upper tier of generating tubes, while the uncondensed steam in the expansive vessel escapes by a pipe in the side of the vessel *n*, at each successive stroke of the piston, and is conveyed off by the flue of the furnace. The momentum of the fly-wheel elevates the piston to the top of the cylinder, and the operation is repeated as already described. Such is the manner in which this powerful machine is worked.



I will now proceed to notice a few of those obstacles which Mr. Perkins has had to surmount, and which, at first sight, appeared insuperable. First, the carbonizing of the lubricating materials, employed to reduce the friction, such as oil, tallow, &c. This he has accomplished by availing himself of the important discovery of a peculiar metallic alloy, with which the piston has been constructed, that requires no grease whatever, the friction being less without, than with, the use of it. Secondly,—keeping the joints of the pipes steam-tight:—This is effected by a very novel and beautiful mechanical contrivance, shown near B, (fig. 1,) but on an enlarged scale by the figure in the margin; *b* is a piece of metal of the figure of two cones united at their bases, with their apexes inserted in the pipes *d d*; *c c* are flanches fixed to the pipes, and connected by regulating screws *a a*, which being turned draw the pipes *d d* firmly in contact with the intervening cone *b*. In this same manner the flanches of the furnace are made to tighten the transverse short connecting pipes already described. Thirdly,—Preventing any accident that might arise from the steam in the chamber L, fig. 2, becom-



ing surcharged with caloric.* Even since the short time that this engine has been constructed, two valuable improvements have been made by Mr. Perkins, proving, were it necessary, the accuracy of Dr. Birkbeck's remark, that in these machines there is yet ample room for the inventive powers of the ingenious. The first of these consists in a mode of shutting off the steam at $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{3}$, &c. (as may be required,) of the stroke of the engine; it is accomplished thus, and is an improvement on the lever G in fig. 1. *a* is the lever, *b* a shoulder containing the wedge *f*, *c* an adjusting screw, to shift the wedge backwards or forwards. Now the cam, *e*, in its action will have to traverse round the hollow curved end of the wedge, and will consequently prolong the time of admission for the steam to the cylinder; *d* is a crank handle to adjust the screw and wedge *c* and *f*. The other improvement consists in reversing the motion of the fly wheel; a circumstance Mr. Perkins justly thinks invaluable, especially in whim engines for mines, and also for steam navigation. The cam F, fig. 1, is dotted, and supposed to show the situation of it on the opposite side of the wheel; in the improvement, Mr. Perkins has put one on this side of it, and so arranged, that when the connecting rod and crank are rising toward the dead point, by shifting the lever G on the cam on this side, the steam is immediately re-admitted, driving the piston back, before it reaches the top of the cylinder, the force of which reverses the motion.



The following are among the advantages that result from the use of this engine. First,—Its *perfect safety*, resulting from the immense strength of the generating tubes; and should it be possible to burst them, that effect would, in all probability, take place without displacing a single brick in the furnace. Second,—A *reduced consumption of fuel*, equal to one half. Third,—Its *diminished bulk;*—and Fourth,—Its greatly *reduced cost* when compared to other engines, and the facility of making repairs.

The following proportions of the engine may, perhaps, be acceptable information:—

The power is calculated to be equal to 30 horses. The fly wheel 8 ft. diameter,—weight 28 cwt. Diameter of piston 8 in.—stroke 20 in. Circumference middle of connecting rod 10 in.—length of do. 3 ft. 7 in. Circumference of piston rod $6\frac{3}{4}$ in. Do. of steam pipes, BD, fig. 1. $5\frac{1}{2}$ in. The remaining minute parts may be examined by the scale for both drawings, attached to fig. 1.

Mr. Perkins's method of showing the power of his engine, (the accuracy of which he does not conceive equal to that of pumping or grinding, neither of which were convenient for him to adopt,) was, however, near enough to show great economy in the consumption of fuel; it is as follows. A strong lever is made to press on the periphery of the fly wheel, the long arm of which is eight times the length of the short; and on the end of the long arm of the lever weights are suspended. Its best action I will now state: the steam at 800 lbs. pressure per square inch, being admitted into the cylinder, and shut off when the piston had made one-eighth of its stroke, it made an average of 60 strokes per minute. The weight on the end of the lever was full 300 lbs. from which *deduct two-thirds, for the difference between weight and friction, which was found by experiment to be within a fraction of correct*, and the following calculation will show the extraordinary result.

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* Mr. Perkins has a very novel and effectual mode of accomplishing this, which we were confidentially made acquainted with, but are not warranted in disclosing at present. [*Editor of the Register.*

300 lbs. is the weight on the end of the lever; this being multiplied by 8, the difference between the long and short arm, gives 2,400 lbs. as a constant pressure on the periphery of the wheel.

This wheel being 25 ft. in circumference, and making 60 revolutions per minute, gives (25 × 60) 1,500 feet velocity per minute.

1500 feet velocity, multiplied by
2400 the pounds pressing on the wheel,
——— gives
3,600,000 This multiplied by the minutes in an hour,
60
——— produces
3)216,000,000 which, divided by 3, the difference between
——— weight and friction, gives
72,000,000.

Whence it would appear that 72,000,000 lbs. was raised one foot high with 42 lbs. of coal, which was the amount consumed each hour.*

This method of testing the power of the engine is not so erroneous as some appear to imagine. To ascertain the difference between this kind of friction and weight, the wheel was fixed, and a given weight (using the same rubbing surfaces) was made to move with about the same velocity, as the wheel moved in the experiment. A weight being suspended over a pulley drawing the weighted lever horizontally, it was found that one pound would give motion to three. Many experiments have been made at different densities, and the results went to prove that the higher the steam was compressed, the greater was the saving of fuel; for it takes but very little more fuel to generate steam of 50 atmospheres, than that of 25.

I cannot close without expressing the great obligations I am under to Mr. Perkins for the very handsome manner in which he has furnished me with the information necessary to enable me to make this communication; and for the obliging readiness he displayed in the full explanation of his interesting and useful improvements.

I remain, Sir, yours respectfully,
Christopher Davy.
[*Ibid.*

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* This, I believe, is only about 1-5th of the consumption of Boulton and Watt's engines.

Account of the first comparative trial of Mr. Perkins's New Steam Engine.

We have the pleasure of announcing, that Mr. Perkins has at length, in a very satisfactory manner, proved the superiority of his newly constructed high pressure steam engine, by working it against two other steam engines, upon the low pressure principle.

This small engine, which we have several times mentioned in our present volume, has been, within these few days, set up at St. Catherine's Dock, and employed in pumping water from the excavation. There have been four steam engines engaged in the prosecution of these works; two for excavation, and two for pumping out the water. Mr. Perkins's engine stands along side a low pressure engine, of sixteen horse power, which is determined by the area of its piston.

The diameter of the piston, that is, the bore of the steam cylinder of the new high pressure safety engine, is eight inches, and its stroke twenty inches. It was connected, by gear, to a beam that made sixteen vibrations per minute, and raised two alternating pump buckets, the diameters of which are fourteen inches, and their strokes three feet three inches.

We were extremely anxious to communicate our observations on the effect and action of this engine, but the first time of its working can hardly be considered to be a fair criterion of its capability. We understand that it is expected to perform twenty strokes per minute, and will then, it is said, lift 900 gallons of water every minute. Our limits will not allow us to say more upon this subject at present, but we intend to take a more deliberate view of the engine in a few days, when it gets fully into action. We think it important, however, to subjoin the following certificates, which speak for themselves, and require no comment from us.

"We, the undersigned, certify, that there are two low pressure steam engines, employed night and day in discharging the water which flows into St. Catherine's Dock, from the land-springs, &c.; that one of them is a sixteen, and the other a ten horse engine. We also certify, that Mr. Perkins has recently put up a small high pressure steam engine, the diameter of whose piston is eight inches, its stroke twenty inches; and that we have seen this engine pump the same quantity of water from the Docks which has been heretofore pumped by the other two."

James Lamon,
Pearson Woodward,
Thomas Browne.

"I, the undersigned, certify that I have superintended, and put up, Mr. Perkins's high pressure safety engine. I also certify that what is stated by the above engineers is true, and that it was done with only 42 lbs. of coal per hour. Having been engaged twenty two years in making and putting up engines, principally in Cornwall, it is not likely that I could be deceived as to the power and efficacy of this engine; and I confidently believe, that two thirds of the coals used in this country might be saved by the use of this engine."

Henry Hornblower.

"I, the undersigned, carefully weighed the coals, and placed them under Mr. Perkins's generator: and certify, that 42 lbs. wt. of coals only, was used per hour. I also certify, that what is stated by the above engineers respecting the work done, is true." W. HERNE.

Mr. Perkins is of opinion that the two low pressure engines could not have been worked up to their full power, although they used the full quantity of coal, three and a quarter bushels per hour; but admitting they worked at only two thirds of the power, there would be a saving of about three fourths of the coal consumed in low pressure engines, by the employment of Mr. Perkins's new principle.

[*Newton's Journal.*

On the new High-pressure Steam-engine, constructed by JACOB PERKINS, *Esq. Civil Engineer, London.*

THE Editor was highly gratified on Wednesday, the 10th ult., (July) by witnessing the performance of this engine at the St. Catherine's Docks, where, as Mr. Hornblower, (a nephew of the celebrated Mr. Hornblower,) the intelligent engineer and superintendent of it, informed him, it had been incessantly at work, night and day, from 12 o'clock on the Friday night preceding, and had, alone, kept the excavations free from water, although the river had once made an entrance to a very considerable extent.

At the time the Editor saw it, it was working two pumps; but, owing to its having got the water so completely under, it was then drawing air mixed with the water.

Mr. Hornblower stated, that it was then working at a pressure of about 270 lbs. upon the square inch, it not being one-third of its full power; and that it only consumed at the rate of one bushel of coals per hour; but that it ordinarily did the work of a 12-horse engine.

Its motion was exceedingly rapid, and indeed it was necessary to abate its velocity by the introduction of a pinion, fixed upon its main-shaft, working into a larger toothed wheel upon the crank-shaft which actuated the pumps; and, owing to its working with so great a velocity, one of the great advantages of working high-pressure steam, the engine itself is of a very light construction, not requiring such massive shafts, &c., to be employed, as in the ordinary cases of the low-pressure steam-engines.

Mr. Hornblower stated, that another engine employed to drain the excavations, consumed two and a half bushels of coals per hour.

[*Gill's Technological Repository.*

Remarks on the phenomenon in the emission of Steam, discovered by M. Clement, and on its influence upon Safety Valves. BY J. PERKINS, *Esq.*

TO THE EDITOR OF THE LONDON JOURNAL OF ARTS, &C.

SIR—Seeing in your Journal the report of a paper, presented by M. Clement, to the Royal Academy of Science, in Paris, on a newly observed phenomenon connected with steam valves, (see p. 97) I have thought it desirable to request your insertion of the following remarks upon M. Clement's discovery, consisting of my own views on that subject, and of, I think, a satisfactory explanation of the phenomenon, which, by the general tenure of his paper, appears not to have occurred to M. Clement.

M. Clement, in his communication to the Royal Academy of Science, in Paris, on some singular results observed by him, connected with steam, observes, that when steam is greatly compressed in a boiler, so that a strong current is made to blow out through a small orifice, on a metal plate, or disc, being presented at a little distance from the orifice, it is forcibly repulsed; but if it is brought near, and pressed, so as nearly to close the orifice, and cause the steam to escape in a radiant direction, or star-like form, round the outside of the disc, an external pressure will be found to act upon the disc, and it can only be set at liberty by forcibly raising it.

The phenomenon in steam, observed by M. Clement, is very curious, and at first sight appears unnatural; but nevertheless it is truly philosophical. In experimenting on high steam, particularly on the phenomenon of its rushing from the stop cock at so much lower a temperature than when in the generator, I observed that a strong current of air was constantly rushing into the stream of steam, and passing off with it, which was proved not only by its taking into its current atoms of dust, but also by its drawing, at a distance of six or eight inches, the flame of a candle from its wick. This current of air would, of course, cool down the steam, and that in proportion to its velocity. Knowing this fact, it is easy to understand the cause of the disc being pressed so strongly against the aperture.

The steam passes off horizontally in every direction, as M. Clement observes, in a star-light form; now as a strong current of air will be created by the velocity of the steam, and pass off with it, the surrounding air will follow, and in its course it will impinge on the disc and cause a pressure, and that in proportion to the height or velocity of the steam. When the safety valve is so constructed, which is sometimes the case, as to allow the steam to pass off in a horizontal direction, the pressure will be much greater than when the valve is conical, which gives a different direction to the steam, making it more difficult for the air to impinge on the valve. The valve placed on the generator of the high pressure safety engine is so small, and so nearly cylindrical, that the stream, when it issues from the valve, causes the molecules of steam immediately to join and form one volume, carrying the current of air upwards, as the steam passes nearly perpendicularly. No air can, of course, come in contact with the valve, and probably a partial vacuum would be made immediately over it. This evil may be very easily remedied, by obliging the steam to rush into a tube rising twelve inches, or more, above the valve. In fact all steam boats are provided with a steam box, into which the steam rushes, which necessarily prevents the current of air from acting on the valve. The steam issuing from the safety valve would then pass off perpendicularly, and prevent the admission of the atmospheric air, which created the pressure on the disc, observed by Mr. C. Mr. Penn, of Greenwich, has a valve affixed to his high pressure boiler, and it is so constructed as to have the steam pass off horizontally. Mr. P.'s son informed me, that he has observed the mercury to indicate an increase of from 80 to 100lbs. per inch, after the steam began to escape from the safety valve; it was undoubtedly from the above-mentioned cause. Science is much indebted to M. Clement for his discovery, for although this phenomenon has been observed in strong jets of water rushing from a fountain, as well as in strong currents of air rushing from the blower of a blast furnace, yet M. Clement is, undoubtedly, the first who observed it in steam, and also the first who has warned the public of the danger of using this kind of safety valve.

I am, Sir, yours, &c.
J. Perkins.

Fleet-street, London.

ENGLISH PATENTS.

Wass's Patent Improved Furnace for rendering the smelting of lead ores, and other mineral substances, innoxious to the surrounding neighbourhood; and by which the volatile products are condensed and preserved.

Mr. Jeffrey of Bristol obtained a patent for a very effectual mode of condensing the deleterious vapours arising from the smelting of metals, in which contrivance it is, however, necessary to have a constant stream or shower of water from the top of the chimney shaft. But as a sufficient current of water can be obtained in comparatively few situations, the improved arrangements of the patentee (Mr. Joseph Wass, of Ashover, Derbyshire,) become especially deserving the attention of persons engaged in smelting works generally: for in addition to the advantage of obviating the injurious effects upon vegetable and animal life within the range of the metallic vapours, there results, from the adoption of this improved construction of furnace, a considerable profit; which arises from the product obtained by the condensation of those volatile and deleterious particles that are usually allowed to mix with the atmosphere. In the specification before us the patentee says, and we believe with perfect truth, that—" By the employment of this improved apparatus, smelting and calcining furnaces are divested of their pernicious effects, and such works may in future be erected in any convenient situation, either near to dwelling houses, or by the side of public roads, or on the banks of navigable rivers, or canals; and thus, in many cases, produce a very great economy in the expense of carriage. The saving effected by this apparatus in preserving a quantity of valuable matter, which would otherwise, as heretofore, escape, to the injury of the neighbourhood, would of itself amount in one year, where four furnaces are employed (as described in the plan) to a sum equal to the entire cost of the improved apparatus; that is, the upper part of the tower, with its roof, cap, vane, shutter, and appendages,"—which we shall next proceed to describe.

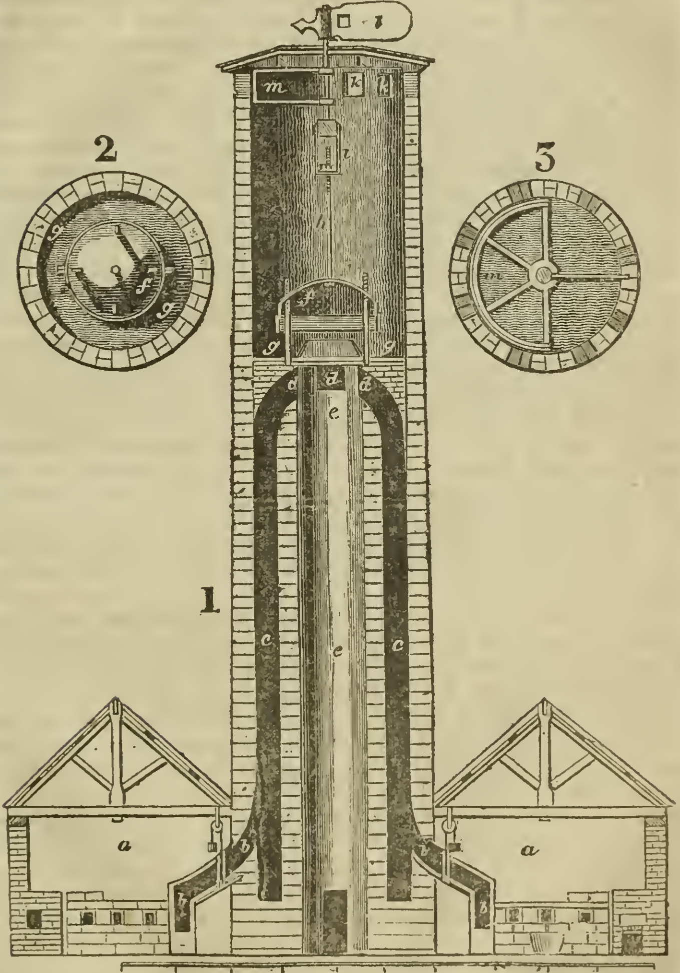


Fig. 1, in the preceding engraving, represents a vertical section of a lofty and capacious tower, placed in the centre of four smelting furnaces, and receiving, by distinct flues, the smoke and vapour from each of them. The drawing being a *central* section, but two of the furnaces are brought into view, which are marked *a a*, their flues *b b*, opening into separate chimneys *c c*, in the tower, which they ascend for twenty, or more, feet, then by lateral passages, at *d d d*, they respectively enter the central shaft *e e:* here the vapours come in contact with a powerful ascending current of cold air, and are likewise checked in their upward progress, by striking against a dome or cap of iron *f*, which is suspended over the throat of the central shaft *e*. The ascending vapours, thus intercepted and acted upon, are, for the most part, immediately condensed, and the metallic particles are precipitated upon a floor *g*, called the *lodge floor*. A plan of this floor, and the cap *f*, are given in a separate figure (2), which is a transverse horizontal section of the tower, just above the cap; another advantage resulting from this arrangement, consists in the effect produced in the furnaces below, where it is found that the carbonaceous matter is more completely consumed than by the former disposition of things. Such portion of the heavy particles that do not fall upon the lodge floor, are precipitated to the bottom of the central shaft. The cap *f* is suspended by a vertical rod *h*, which is connected to a transverse beam, by means of a sort of stirrup-iron *i*, through which the upper extremity of the rod is screwed, and by the turning of a nut upon this screw, the height of the cap above the throat of the central shaft, is regulated. The cap is steadied in its movements, and preserved in its position, by several upright bars passing through it, two of which are brought into view; these are perforated with holes, through which, keys or bolts are put, to lock the cap securely in its place. The lower part of the cap or dome is circumscribed by a broad hoop; by the action of regulating screws, this hoop is shifted up or down over the periphery of the cap, and the passage for the vapours is thus more readily adjusted at pleasure.

The more volatile portion of the vapours pass from under the dome, and ascend to the top of the tower, which being covered with a roof nearly flat, the heaviest particles are driven back, and fall condensed also upon the lodge floor, while the lightest and least pernicious, escape into the atmosphere at the lateral openings *k k*. There is a regular series of vent holes all round this part of the tower, one half of which, those that happen to be to windward, are always closed by a circular shutter *m*. The lower extremity of the shaft, upon which the vane *l* is fixed, turns in a bearing upon the cross beam; and the arms of the circular shutter being also attached to this shaft, when the wind turns the vane, the shutter is, consequently, in like manner turned against it. Fig. 3 is a transverse section of the tower immediately under the roof, by which the circular frame of the shutter is shown, as closing one half of the apertures, or those to windward of it.

When the deposition from the condensed vapour has become considerable, it is removed from the lodge floor, at a time when the smelting furnaces are not at work. This is done by a man ascending a narrow circular staircase, constructed in the masonry of the tower, up to the lodge floor, where he throws down the accumulated deposition, with a shovel, to the bottom of the shaft; from thence it is barrowed out, and carried to a roasting furnace.

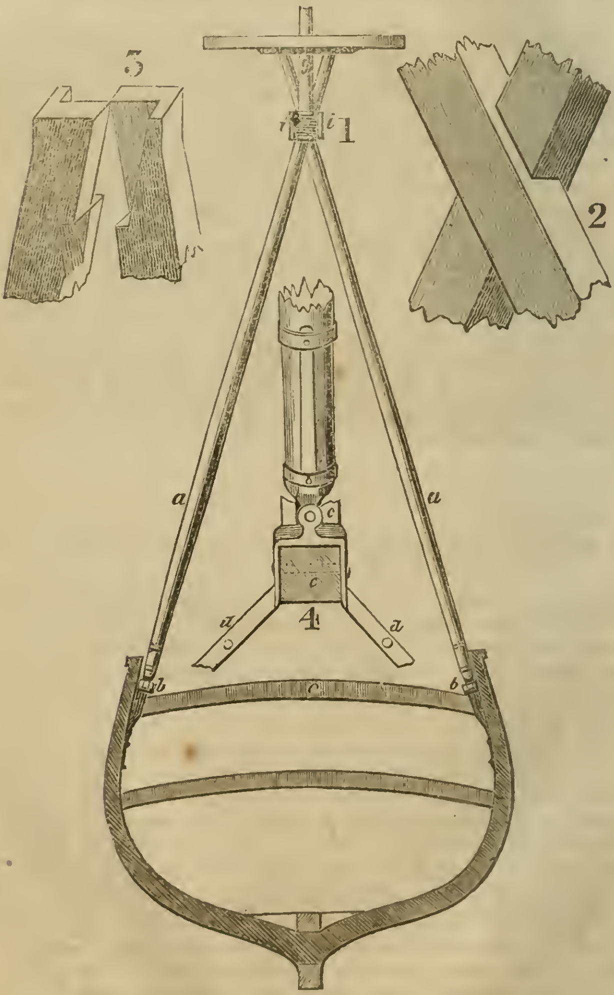
When any one of the furnaces is not at work, communication with the tower is to be cut off by means of a damper, as those shown at *o o*.

In the drawings attached to the specification, a general plan of a smelting work is delineated. The area is inclosed by a quadrangular wall, with a smelting furnace on each side, the chimneys of which are conducted into the central tower. The corners of the quadrangle are occupied by the other buildings required in such establishments. The spaces between the angles of the several flues, the patentee states, may be conveniently occupied by small furnaces for tests and experimental purposes. Another improvement of the patentee deserves mentioning; he directs that the tapping sides of the contiguous furnaces be made 'opposite' to each other; by which is meant that they may both face the area which lies between them, in order that the fluid metal from the pans of each furnace may be run into pigs, or conveyed into one receiver, and thence into a mould, so as to be formed into thick sheets, ready for milling or rolling: by which arrangement of the furnaces, it is considered an important saving of labour and expense will be effected, and the waste, by remelting the lead, avoided.

[*Ib.*

Patent to T. R. Guppy, Esq. for Substitutes for Masts.

These are termed in the specification, "improvements in masting vessels;" we have taken leave to call them *substitutes for masts*, and it is with pleasure we add that we think the substitutes very superior contrivances to the latter, as respects convenience and general utility. Instead of a single pole fixed into the keel of the vessel, in nearly a vertical position, constituting what is called a mast, the patentee employs two poles or spars, the lower end or heel of each of which is fixed on to the opposite extremities of the beam of a vessel, and likewise to the sides; the poles are then so inclined to one another, as to be connected at their upper extremities, and thus to form, with the line of the deck, an isosceles triangle: this is the outline of the construction as applied to sloops, or ordinary fore and aft rigged vessels. For square rigged, or larger vessels, the poles are not joined at their upper extremities, but at several feet below it, where they cross one another, presenting the figure of a pair of shears. In all cases, however, the lower ends of the poles are fastened in the situation, and in the manner before mentioned. Thus situated, they are invested with the important property, or capability, of being lowered forward or aft, as occasion may render desirable, by the introduction of hinge joints, at their extremities, close to the deck. At the junction of the poles above, suitable arrangements are made for setting top-masts thereon, which are provided with gear for that purpose, as well as for the masting of other vessels, for loading or unloading a vessel, and for other purposes to which *shears* are usually employed on board of ships.



The principal rigging for these "double pole masts" will be the fore and aft stays, the ordinary side shrouds being comparatively unimportant, except for the purpose of going aloft.

At Fig. 1, *a a*, are the two poles, having joints at *b b*, from whence proceeds a strong iron band which clasps the opposite ends of the beam *c*, which, underneath, diverges into two iron straps that are bolted to the sides of the vessel. This will be clearly understood by an examination of Fig. 4, which gives a perspective side view of the iron work which connects the poles to the vessel, with a portion of the beam, and a pole; *c c* is the beam, with the iron band bolted to it, and showing the straps *d d* that are secured to the sides of the vessel, and are turned for that purpose flat ways towards them. The poles are connected together at *e* by a stout iron band, by scarfing and crossing each other, as shown by the separate Fig. 2 in perspective: *f* is the top, where the upper ends of the poles are strongly secured to one another by straps and bolts: *g* is the lower end of the topmast which passes through a hole adapted to it in the top, with its heel resting upon an iron projection, which is of one piece with the band *e*.

For sloops, and fore and aft rigged vessels generally, the poles *a a* terminate at their junction, and are united by scarfing, previous to putting on the strong iron band. The mode of scarfing, the patentee leaves to the genius of the mast-maker, but at the same time points out *one* mode which he most approves of, and which, perhaps, cannot be excelled: this mode is shown by the perspective Fig. 3. Connected to the band which unites the poles together, are fixed long iron links, *i i*, for hooking on, or "*seizing*" the shrouds to.

Those of our readers who may desire further information, may consult the Repertory of Patent Inventions, for November last.

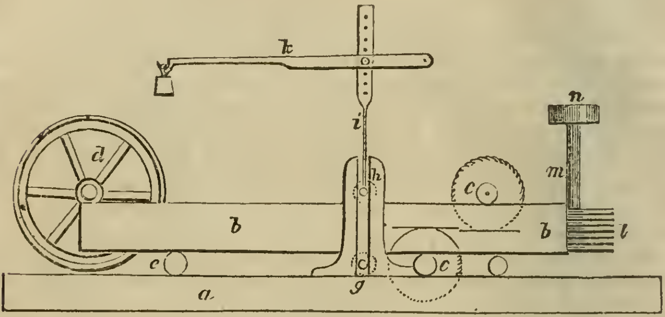
[*Ib.*

Patent granted to George Sayner and John Greenwood, for Improved Sawing Machinery.

The improvements in Saw-mills projected under this patent, relate to three distinct particulars; each of them presumed to be an improved application of the circular saw.

The first, and the most important, consists in the employment of two circular saws, instead of one, to cut through a piece of timber. According to the usual method, in sawing through a log of two feet in thickness, a circular saw of about five feet in diameter is required, as the cut cannot extend to the full semi-diameter of the saw, on account of its axis and the strengthening flanch; but by the new arrangement of the patentees, the operation is accomplished by two saws, each of little more than half the diameter of the former; they are placed therefore on opposite sides of the timber, where each of them makes an incision rather more than half way through; the log is thus divided completely, effecting at the same time a very considerable saving in expense of power, and in the cost of saws.

The annexed diagram will, we trust, be found sufficient to explain the matter, clearly: *a* the bed of the saw-mill; *b b* the log of timber under operation: *c c* the two circular saws, the depths of their respective cuts being shown by two fine lines; these saws have pulleys upon their axes, and are driven by bands which embrace them, and the drum wheel *d*, motion being given to the latter by a water wheel, steam engine, or other power.



The timber rests, and moves, upon horizontal rollers *e e*, and is guided accurately to the saws by vertical rollers, (not shown in the engraving), as usual in saw mills. The axes of the saws running in fixed bearings, the timber is forced against them by the propelling roller *g*, which is caused to revolve by another band from the drum wheel *d*, the axis of the roller being confined by the upright frame at *g*: in the upper part of this frame is also situated the axis of the *pressing roller h*, which being connected to the vertical bar *i*, is pressed upon by the weighted lever *k*; the roller *g*, therefore, gives the motion, and the roller *h*, a steady firmness to the advancing position of the log.

If the timber is to be cut into planks, a number of circular saws are placed together on the axes of *c c*, with flanches between them of the thickness of the intended planks, and bolted together; by these means, the whole log is, at one operation, formed into boards; and if it be required to cut the log into scantling, or laths, a series of horizontal saws *l* placed, in like manner, upon a vertical axis *m*, and driven by the pulley *n*, cuts the whole at once into those small divisions. This mode of applying the saws to work in a horizontal plane, so as to operate simultaneously with those acting in a vertical direction, is the *second particular* improvement alluded to at the commencement of this article.

The third improvement claimed, is for uniting the plates of a series of saws closely together, so as to make one compact body of saws, without any interstices between them, for the purpose of reducing dye-woods entirely to saw dust, or powder, instead of the usual method of chipping or rasping them for the purposes of dying, or other chemical operations.

[*Ib.*

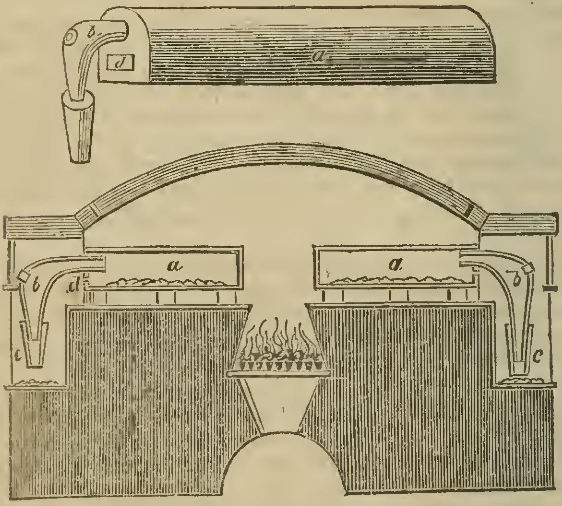
Patent granted to Mr. Benecke, Verdigris Manufacturer, and Messrs. Shears, Coppersmiths, for an Improved process in preparing Zinc or Spelter.

In the ordinary method of preparing zinc, or spelter, the ore is exposed to the heat of a furnace, in a melting pot, from the bottom of which a pipe descends into a vessel of water, for the purpose of receiving the metals as they are melted, and for condensing such portions as pass off in the form of vapour. An improvement upon this mode was the subject of a patent about fifteen years ago, in which it was so arranged, that as the zinc volatilized, the vapour should be received, and condensed, in a separate vessel, leaving the melted metal, such as lead, and other impurities, in the former. Now the new process we have to describe, is an improvement upon the latter mode; it consists, firstly, in a peculiar treatment of the ore, previous to its introduction into the furnace; and secondly, in a peculiar arrangement of the retorts and other appendages, by which a more convenient mode of charging the retorts is obtained, and a purer metal is the result.

The ores are first to be roasted in the ordinary way, by stratifying them with fuel, and setting fire to the pile. The ore is next spread out in the air, and lixiviated, to separate the sulphate of zinc; it is next to be dried, pulverized, and roasted a second time, until the sulphur is extricated; when it should be powdered again, and mixed with an equal quantity of carbonaceous matters, such as powdered coal, charcoal, cinders, &c.; in this state it is to be saturated with an alkaline ley, or a solution of common salt; the solutions varying, according to the nature of the ore. Calamine, or other oxides of zinc, will require only to be pulverized and calcined.

With the ores prepared, as before mentioned, the retorts are to be charged; one of these is shown in perspective at *a* in the annexed figure; they are made of fire clay, or such earth as will best stand the heat of the furnace. To the front end of these retorts, are two apertures; the upper, circular, for the reception of the neck of an earthen head piece *b;* the lower, *d*, is square, for clearing out the residuums after working, which is closed during the distillation, by a stopper, and luted. The head piece has likewise another tube fitted to it, and luted, merely for the purpose of lengthening it, sufficiently to allow the vapour to cool as it descends, and to condense upon an iron-plate beneath, as shown in the lowest figure in the diagram; which represents a cross or vertical section of a reverberatory furnace, in which a double row of such retorts may be supposed to be arranged, with a long aperture between them where the fire is situated, which rests upon a grating over an arched passage, that communicates with the open air outside the building: this arched passage has a door, by the opening and shutting of which the heat of the furnace is regulated as may be required: and through one of the ends of this long furnace an aperture is made for supplying it with fuel.

The earthen head pieces, *b b*, it will be observed, have an aperture supplied with a stopper; through these openings, the ore and carbon, prepared as before mentioned, are introduced in sufficient quantity, by means of a ladle, into the body of the retort; when the apertures are closed and luted. The operation of distillation then commences; the zinc which rises in vapour passes into the head pieces, *b b*, down the pipes *c c*, and falls upon the iron plates beneath, in a condensed state.



By the arrangement described, the head and neck of each retort is placed in a square recess or neck by itself, by walls built out between them, so that each may be perfectly closed in, by a door, from wall to wall. The doors are made of latticed wire work, for the purpose of holding clay when plastered over them, for the purpose of effectually confining the heat within the furnace; each of these doors has a central eye hole, provided also with a stopper, for watching the progress of the operation, and for enabling the workmen to determine the degree of heat to be applied, and other circumstances.

By another arrangement, the Patentees propose to erect furnaces, with several tiers of cylindrical retorts, placed one above another, with their necks or heads projecting beyond the front wall. The fire place is *covered* by a low arch, to prevent the fire acting too violently upon the lowermost vessels; but through the arch, apertures are made for the circulation of the heated air among the vessels above.

[*Ib.*

To Charles Freund, *of Bell Lane, Spitalfields, in the County of Middlesex, Sugar Refiner, for his Discovery of an Improvement or Improvements, in the process of Refining Sugar.*

The improved process employed by the patentee for refining sugar, which he denominates clearing the pans, is intended to supersede the present practice of using bullock's blood, and such other albuminous matters; and consists in the application of pot, or pearl ash, and fuller's earth, to the sugar in the boiler or pans, as a means of removing the colouring matter.

The process is as follows:—In the pan usually employed for boiling the sugar, a quantity of water is placed, say eighty-four gallons, to which fifteen pounds of American pot or pearl ash is to be put, and to these, eighteen hundred weight of raw, or Muscovado sugar is to be added. This compound having been well stirred, to break the lumps, mix the whole perfectly together; from twenty to thirty pounds of the whitest fuller's earth, dissolved in water to the consistency of cream, is now to be added, and the whole well agitated during the boiling process, and fresh water introduced as the process goes on, to keep the sirop in a sufficiently fluid state.

As this clarifying process goes on, the boiling is to be occasionally suspended, for the purpose of removing the scum, which will float upon the surface, and when the boiling has been continued for a sufficient time, the sirop is to be withdrawn in the usual way, and placed in a vessel for the purpose of settling.

This vessel is to be furnished with three cocks at different heights from the bottom, by means of which the sirop is to be withdrawn as it becomes settled, and clear: drawing, of course, from the upper cock first, after it has stood perhaps twelve hours to settle, and the next day from the second cock, and so on, until as much has been drawn as will run clear.

The vessel is then to be tilted, which may be done by depressing one end, and for this purpose it is erected upon a frame supported by an axle, placed a little distance from the centre, the other end of the frame being sustained by a leg which is a screw. In the first instance the vessel is placed perfectly level, but when the sirop has been drawn off, down to the level of the lower cock, then the vessel may be tilted by turning the screw leg, and the remainder of the sirop drawn off as long as it will run clear.

The remainder of the sirop, with the sediment, may be ultimately withdrawn, by removing a screw plug, placed in the bottom, and this with the scum, or any other thick or coloured sirop, may be again put into the clearing pan, and operated upon as described above.

The patentee states, that his claim of invention is simply the employment of pot or pearl ash, or other such vegetable alkaline matter, with fuller's earth, for the clarification of sugar, and that the same is applicable to clarifying of sugar, or molasses, in different states, that is, it will apply to the clarification of the raw Muscovado sugar,

to the bastards, and to the molasses, all of which purposes come within the meaning of his patent right.—Enrolled January, 1826.
[*Newton's Journal.*

ESSAYS ON LITHOGRAPHY. No. III.

Lithographic Crayons for Drawing on Stone.

It is impossible to obtain beautiful lithographic impressions, if the crayons used by the artist, have not the requisite qualities. The ingredients of which they are composed, ought to be of such a nature as to adhere firmly to the stone, after the design has undergone the preparation by the acid, as well as during the process of drawing it. They ought to be sufficiently hard to admit of being brought to a very fine point, and to allow the artist to make clear, and well-defined lines, without the danger of breaking it off. If they are made too dry or porous, they are subject to break very frequently; if too soft, they crumble, and will only form coarse and confused lines, making it impossible to produce a drawing possessing character and neatness. It would be rendering a great service to Lithography to discover the means of forming crayons as hard as those made of black lead, so as to be able to trace, on stone, lines as fine, and clear, as those made with these pencils. It is in fact an improvement, which the art yet requires. The following composition, however, is, in the present state of Lithography, found to answer the purpose.

Soap, from suet, or tallow,—dry -	150 parts.
White wax, free from tallow - -	150
Lamp black - - - - - -	25

The soap and the wax are to be put into a covered skillet, on a brisk fire; and when the whole is perfectly melted, the lamp black is thrown in, a little at a time, taking care to stir the mixture continually. The common lamp black of commerce, may answer, without its being necessary to calcine it; but when, as is sometimes the case, it contains particles of sand, or earth, it must be rejected; it ought also to be extremely fine. The whole should be allowed to boil, for a few moments, in order that the mixture may be complete; the composition is then poured into a mould of wood, or of brass, which is made to open, and shut, at pleasure, and in which twenty-five or thirty crayons may be formed at once. It is necessary to rub the mould with oil, to prevent the material sticking to it. After having filled it, it is opened, and the crayons removed; it is then closed again, and fresh matter poured in, which must be kept very hot. A flat plate of metal is sometimes used instead of a mould: it must be made warm to prevent the composition cooling too rapidly, and be surrounded by four ledges of wood, in order that the melted mass may not run over the edges; a quantity is then to be poured in sufficient to make the crayons of a convenient thickness. The pieces of wood are immediately removed, and the material is cut, with a knife, into such strips as to form crayons of the desired size. It is necessary to be very quick in this operation, that the paste may not have time to cool, for in this case it would break under the knife. The crayons thus cut, will separate readily from the plate, if care have been taken to rub it with oil. The formation of air-bubbles is prevented by allowing the boiling to cease for a moment, before pouring out the matter, or by pressing it with a stone, or some other body, that has been made warm.

Lithographers submit the materials which they employ in the composition of their crayons, and even their ink, to the action of burning; but this method is, nevertheless, a very bad one, as in the combustion, a part of them is entirely destroyed, and it is besides impossible always to obtain, with certainty, crayons of the same quality. Some persons pretend that it is necessary to use different kinds of crayons during the progress of the drawings; but, if the artist have a really good crayon, he will find it answer equally well for every part of his work; or the utmost that can be required, is a trifling difference in the degree of hardness given to them; which difference may be effected, by increasing, or diminishing, the quantity of wax in the compound; or by adding to it a little mastic. Another composition has been recommended for crayons called *retouch crayons*, and which are used for repairing those parts of a drawing which are accidentally detached from the stone, during the operation of drawing; but a crayon which is suitable for forming the design in the first instance, will serve equally well for these retouches.

Printing Ink.

This ink differs from that used in typography, in being much thicker. In order to form it, a varnish is made of linseed, or nut oil, with which is ground up a certain quantity of lamp black. The older the oil is, the better is the varnish. This ink should not be too thin, or liquid; nor must it be too strong, or thick. If, when mixed with the lamp black, it be found to possess the first fault, it will extend itself beyond the lines and points which form the drawing, and be widened still more by the action of the roller, or of the press, in obtaining the impressions; and, in the end, would adhere to the stone, or fill the spaces between the lines, notwithstanding the water used to prevent these effects; it will also the more readily be imbibed by those parts of the stone which have not been covered by the crayons, or the ink, used in drawing, which will also be softened, and the harmony of the design be destroyed. If it be too thick, if the lamp black be not well incorporated, or any heterogeneous substances be mixed therewith, it will not take well on the delicate points and lines; it will be apt to break them up, or choke the spaces between them, and unite them together, as they will be liable to crush by the force used in taking the impressions.

The same means are used in making this varnish, as are employed in preparing that which is used for letter press: that is, in an iron or a copper vessel, a quantity of oil is poured, sufficient for the varnish it is desired to make; taking care that the vessel is not more than two thirds filled: this precaution is indispensably necessary, in order to prevent those accidents which might occur from the oil boiling over. Even in this situation it may suddenly swell up and boil over; it must therefore be carefully watched; and, when necessary, removed quickly from the fire, or it would inflame, to the imminent danger of every one exposed to its action. When the vessel is thus removed, it is generally placed in a hole prepared in the ground, that it may be more quickly cooled. This preparation should be made out of doors, and in a place where no damage can ensue from such an accident. When the oil is boiled in a fire-place, there should be, close at hand, a heap of ashes, ready to throw on the fire, to deaden it. Some persons put litharge into the oil, to render it drying; but ink, which has been thus prepared, hardens too quickly upon the inking stone, and roller; its tenacity will also cause it to adhere too firmly upon the drawing, and may consequently detach its more delicate parts. In preparing the oil, a few pieces of bread are successively thrown into it whilst it is boiling, and these are removed when they assume a brown colour; onions are occasionally used for the same purpose; the advantage in this proceeding is, however, very doubtful.

The oil requires five or six hours boiling, and even more, when there is a great quantity of it. When it begins to boil, the evaporation is accelerated by stirring it, and lading and pouring it back into the vessel with an iron ladle, furnished with a long handle. A lid is at first placed on the vessel, to hasten the heating of the oil. The oil is to be inflamed at three or four different times, taking care to extinguish it when it burns too fiercely; this may be done by blowing upon it, by placing the cover upon the vessel, and, if necessary, by removing it from the fire. The fire is applied to the oil, by means of a piece of flaming wood, or paper, which is brought near to its surface; if the liquid does not take fire, it is a proof that it is not yet sufficiently heated. The oil is to be laded up, and poured back again whilst it is burning. All these operations should be performed with great care, to avoid injury from the fire, and more particularly from the boiling oil, which burns severely wherever it touches.

In order to ascertain when the oil is boiled enough, and the varnish has acquired the requisite degree of consistence, a few drops are allowed to cool on a piece of glass, or on a plate. When the varnish has been allowed to cool, it ought not to be capable of flowing on the body on which it has been placed; when touched by the finger, it ought, on raising it, to draw out into long threads; and the length of these threads indicates the thickness of the varnish. The consistence of the thinnest varnish, should be a little less than that of common honey; but experience alone can teach the exact degree of thickness which is necessary. For Lithography, two kinds of varnish are in general prepared; one, thick, intended for crayon drawings, the other thinner, for designs in ink; and when it is desired to have one of an intermediate quality, these two are mixed together. These varnishes may be kept in the vessels in which they were made, or in glazed jars; care being taken to cover them closely. If the varnish has been boiled until it is too thick, it may be made thinner, when necessary, by warming it a little, and mixing with it a certain quantity of linseed oil. It may also be tempered without heating it, by rubbing it up with a little oil; observing that only a very small quantity must be used, otherwise it will spread on the impressions, and thus spoil them. A quantity of this varnish, sufficient for a fortnight's work, is taken, and, in small portions at a time, ground up with lamp black, by means of a mullar; carefully observing to cover it, whenever any is taken out for use. The varnish may be thickened, by adding to it a greater quantity of lamp black.

In order to obtain beautiful drawings, a black of the best quality must be used; the lamp black found in the shops, is greasy, and of a brownish colour; and if employed, will produce impressions which will appear dull and rusty. To avoid this inconvenience, that black should be used, which is made of burnt, or rather, carbonized rosin. It is prepared by packing it closely in a crucible, the lid of which is to be luted down with potters' clay; the crucible is then placed in a stove, and covered with lighted charcoal, and thus left until no smoke can be perceived to issue from the interstices around the cover. This black, when taken from the crucible, presents a body sufficiently hard, but friable; it is to be broken on a stone, and pulverized with a mullar, before mixing it with the varnish. Some persons mix with the lamp-black, a small quantity of indigo, to give more tone to the proofs; this, however, is not necessary, when the lamp black is of the first quality.

The public taste sometimes requires that prints or designs should be produced in colours. In this case, the colour required is mixed with common varnish. Those which combine with this varnish, are, for blues, indigo, and Prussian blue; and for reds, vermilion, and carmine; this last colour requires to be rubbed up with spirits of turpentine, to enable it to incorporate perfectly with the varnish. The ochres, when they are very fine, may be used for reds, or yellows; and that of the latter colour, when mixed with indigo, will produce a green. Terra di Sienna gives a brown, &c. The greater number of colours, as they are found in the shops, not being sufficiently free from grit, or other gross particles, to produce good ink, it becomes necessary to mix them in fine powder, with a certain portion of water, in which the grosser matter is allowed to subside, and which is then decanted, and left at rest to deposit the washed colour.

Preserving Ink.

When a stone has been drawn on, all those parts which constitute the design, are covered with a thin coat of printing ink; but this ink, being very siccative in its nature, dries after a certain time, and then takes with difficulty, or entirely refuses to receive the ink with which it must be charged, for the purpose of obtaining a new impression. This inconvenience is but little felt in ink drawings; it being only necessary to cover these with a coat of gum, to preserve them for a great length of time. It is not so, however, with drawings executed in crayons, or with those which are engraved, or with stones intended to produce coloured impressions. These are soon deteriorated, although defended by a coat of gum; they require to be protected by an ink which will always retain its unctuosity. The two following compounds have been found to succeed equally well.

Lithographic varnish, very thick,	2 parts.
Mutton suet,	4
White wax,	1
Oil of turpentine,	1
Lamp black,	4

The three first articles are to be melted over a slow fire, when the oil of turpentine is poured in, mixing the whole well together; then is added the lamp black, a little at a time, stirring the mixture until it is formed into a homogeneous paste. The other composition consists of

White wax,	1 part.
Suet,	2
Oil of turpentine, Lamp black,	as much of each as is necessary to give

a colour and consistency, similar to that of common printing ink.

These inks should be kept in a covered vessel, to preserve them from the dust and air. An inking stone and roller, must be appropriated exclusively to their use. The ink is spread over the stone with the roller; and after having taken an impression of the drawing, it is well cleaned with a damp sponge; it is then charged with the roller, as it would be were another impression wanted; and the stone is then covered with gum water.

In Germany, these precautions are carried to a greater extent. When no more impressions are wanted, and the stone is to be put by for future use, the design is removed from the surface by spirits of turpentine, the stone is cleaned by washing it with water, then inked in the way just described, and then lightly coated with gum water. Before the stone is so disposed of, any spots, or blotches, which may be found upon the drawing, are carefully removed.

When the stone is wanted for new impressions, the gum is first removed, by water and a sponge; the preserving ink is cleaned off by a sponge and spirits of turpentine; the stone is then moistened, and charged with the ordinary printing ink, by means of the roller.

ON GILDING.*

Gilding is an art exercised in various ways, according to the purpose for which it is designed. Its general object is to give to the surface of any article, to which it is applicable, either a matted appearance, or the brilliancy of burnished gold. Wood, plaster, card-paper, leather, metals, such as iron, tin, silver or bronze, are frequently covered with gold. It is also applied on paper, on the edges and covers of books, and upon many other substances.

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* From the Dictionnaire Technologique.

On Gilding in oil.

This is the name given to that species of gilding in which oil is the fluid material used to cause the gold to adhere to the article gilt.

In oil gilding, what is called *gold colour* or *gold size*, is employed, which is no other than what remains of the different oil colours, in the cup in which the artist cleans his pencils. This substance is extremely *fat* and glutinous; after being again well ground, and strained through fine linen, it serves as a foundation, or ground, upon which to lay the gold leaf; this material is to be applied upon a hardened ground of paint, (*teinte dure*) with a common paint brush. The gold size improves by age, as it becomes more fat, or unctuous, the longer it is kept.

The foregoing is the process usually adopted, but we proceed to lay before our readers another, which has been communicated to us by a very skilful operator in this art, and which is to be greatly preferred.

1st. The first operation is to give a priming coat, of colour formed by grinding white lead, in oil rendered drying by boiling with litharge, and tempered afterwards with linseed oil, adding a little fat oil, and a very small portion of spirits of turpentine.

2. Grind *calcined* white lead very fine, in fat oil; this must immediately be tempered with oil of turpentine, as it is subject to become thick very quickly. Three or four thin coats of this are to be given, very evenly, in the ornaments, and on all parts intended to be gilt Care must be taken in applying the colour to the deeper parts of the work, that it may be even and perfect. This is the *teinte dure*, or hard ground, already mentioned.

3. The gold colour, or size, previously strained through fine linen, is then to be laid on, very thin and even, with a soft brush which has been used for oil colours. A smaller brush must be used for the deeper parts of sculptured, or other ornaments, carefully observing to remove any hairs which may be detached from the brush.

4. Where the size is so far dried as to become tacky, the gold leaf is to be spread upon the cushion, and divided with the knife; the gold is placed on with a small block of wood, faced with cloth, called a *palette*, and lightly pressed with cotton, repairing where necessary, with pieces of gold cut small, applied by a badger's hair pencil.

5. If the articles gilt are to be exposed to the weather, as balconies, grating, statues, &c. they ought not to be varnished, as gilding in oil is more durable without, than with, varnish. The heat of the sun, will, after a heavy rain, cause gilding covered with varnish to craze, or crack, over its whole surface. Gilding in the interior of a building, as on the rails of stair cases, &c. should have a coat of spirit of wine varnish, drying it by means of a chafing-dish, and then applying a coat of oil varnish.

6. As the beauty of oil gilding depends greatly upon the manner of varnishing it, this should be particularly described.

The workshop ought to be very warm; the varnish must be spread gently, and evenly, over the work; and a second workman should follow immediately, and warm the surface by means of a chafing-dish, passing it about constantly, to prevent its heating too much in one place, which would blister the varnish. This heating will cause the gold to appear distinctly, as it will render the varnish perfectly transparent, which might otherwise become white and dull.

When marble is to be gilt, as it is ordinarily polished, it does not require the priming coats. If soiled, it must be made perfectly clean; the parts to be gilt should be covered with a thin coat of good oil varnish, then with the gold size, and afterwards gilt.

Gilding in oil is suitable for domes, the outer ornaments of churches, figures in lead or plaster, grating, balustrades, balconies, &c.; and answers equally well, whether the articles gilt, be exposed to, or defended from, the inclemency of the seasons. Oil gilding, however, is also used on carriages, on furniture, &c. This is called *polished varnish gilding*, and is effected as follows.

A portion of white lead, half as much yellow ochre, and a little litharge are separately ground very fine, and the whole mixed with fat oil, thinned with a little spirits of turpentine. This, which forms the first coat, is to be spread thinly, and evenly, on the work.

When the foregoing coat is perfectly dry, a number of coats of hard ground (*teinte dure*) are to be given, even to ten, or twelve, according to the nature of the work; to render the lower parts smooth, generally requires the greatest number. A day ought to be allowed between each coat, and the article should be kept in a warm place, or exposed to the action of the sun; especial care must be taken that the pores in the recesses of the wood be hidden, as well as in every other part.

When the whole is perfectly dry, the flat parts are rubbed down with a piece of pumice stone and water, and afterwards the whole, with a piece of serge, and finely powdered pumice stone and water, until all the streaks of the paint disappear, and an even, glass-like surface is obtained.

After being thus prepared, four or five coats of fine lac varnish should be given, with a brush of badger's hair; this should be laid on lightly, and in a place moderately warm.

When dry it is to be rubbed down with rushes, both on the pannels and the sculptured parts, and afterwards polished with putty, and with tripoli moistened with water, and applied by means of a piece of serge, until it is as brilliant as glass.

In a place perfectly free from dust, and moderately warm, the polished work is to receive a very light, thin, and even, coat of the gold size; it is impossible to make this last coat too thin, as any sensible thickness would injure the work; the brush must be carefully chosen; it must be very soft, free from all dirt, and with the hairs firmly fixed.

As soon as the size becomes tacky, which may be known by touching the back of the hand against the work, the gilding may be commenced. To cover the broader surfaces, a leaf of the book of gold is to be opened, and the edge of the gold applied to the surface, with a slight pressure, releasing and laying the whole leaf, in such a way that it may be spread evenly, without tearing, or doubling; this is called gilding from the book. The leaves are thus to be placed side by side, lapping as little as possible, but observing that every part be completely covered. When small surfaces, and carved work are to be gilt, the leaf must be applied by means of cotton, or by a suitable pencil.

The gilding is to be lightly brushed over with a very soft pencil, or rather with a flat brush of badger's hair, of about three fingers width; and it may then be left to harden for several days.

The work is to be varnished, with a spirit varnish, called gold lacker, or with simple seed lac varnish, warming it in the way formerly mentioned.

When the spirit varnish is perfectly dry, it is to be covered by two or three thin coats of white copal oil varnish, or of gold coloured oil varnish, allowing two days between each coat.

Finally, the pannels are to be polished with a piece of serge, covered with tripoli and water, and a lustre given by the palm of the hand, which is to be moistened with a small portion of olive oil, taking care not to injure the gold, by rubbing one part more than another. Those parts of carriages, furniture, or sculptures, which do not admit of being polished, should have a greater number of coats of the spirit of wine varnish, and two, or three, of the oil varnish.

M. Monteloux-Lavilleneuve, of Paris, who has obtained great celebrity for gilding in oil, and for burnishing all kinds of varnished metal, and who has greatly improved this art, received a patent for his improvements, the term for which has expired; the following is an extract from his patent.

After the pieces are varnished and polished, he applies his gilding ground; for this purpose he heats them, and wipes them carefully whilst warm, to render it certain that not the slightest humidity remains upon the parts to be covered with the ground. In this state of perfect dryness, with a small stick, sharpened like a crayon, he places, in spots, small portions of his first ground upon the work, taking care that the quantity on each spot, and their distances from each other, shall be as equal as possible. This part of the operation must be quickly performed, that the drops first applied may not harden, so as to interfere with the perfect and equal spreading of the ground; this spreading is effected immediately, by first using a stump, or roll, of lutestring, and then a piece of velvet, which equalizes it, and diminishes its quantity as much as is necessary. Without this precaution the gold when applied, will appear black, and will lose its brilliancy. This first ground, or size, is composed of equal parts of the gold size, already described, and of boiled oil.

The next operation is to apply, in a similar way, a second coat, formed by combining together two parts of wax, and one of mastic varnish, made with linseed oil: these are to be used without spirits of turpentine. The spreading of this requires that the article should be warmed in a stove.

A third coat is formed, composed of one part of amber varnish, and two of fat oil, without spirits of turpentine; this, after being laid on with a brush, is to be regulated by the velvet, and some time allowed before the application of the gold. Practice alone can point out the time when it is sufficiently dry for this purpose.

The gold may be applied by means of the small cushion, formed of wood, and faced with cloth, or by a simple card, according to the habit of the workman. When the gold is on, it is to be pressed with a piece of soft skin, and then with clean velvet, in order to give it the uniformity of surface, and the brilliancy required. It is then left to dry in a stove room; after which it may receive one or more coats of oil varnish; taking care that this be not applied, until the gilding has hardened perfectly, otherwise it will absorb a portion of the varnish, and in consequence lose its brilliancy. The varnishing upon gold, preserves it from being rubbed, and renders it capable of being washed, to remove any spots, or dirt, from its surface.

[TO BE CONTINUED.]

Remarks by the Editor.—The experienced workman is generally able to substitute one article for another, in the recipes presented to him; but those who are without experience or skill, are apt to suppose that the process must fail, if there be any departure from what is written down; we add a few remarks for the purpose of correcting this error. The French are in the habit of using the oil gold size, mentioned in the foregoing article; but as it is formed from the various pigments left in the washing of their brushes, it is evident that it must vary in its composition, and in its colour; its use, however, has been consecrated by habit, which is a master of Herculean power The gold size used in England, and in this country, we think a much better article; it is composed of red lead, and fine yellow ochre, ground in fat oil, that is, a thick boiled oil, which has, by age, assumed a fat, unctuous consistence, which gives it a peculiar fitness for this use. Gold size thus made, is of the colour most suitable to hide any defects in the work: it possesses all the good properties of that used by the French, and is free from its bad ones. It may be made in large quantities, and, with proper precaution, be kept for years.

The rushes used for rubbing down, are a valuable article, and grow abundantly in various parts of the Union: they are' to be found in our own neighbourhood, in the State of New Jersey; though extensively used in Europe, they are scarcely known to our workmen. They grow usually to the diameter of a small goose quill, are hollow, and on their exterior surfaces, are as sharp as glass paper, whilst they are much finer; they may be used either wet or dry. Glass paper is our substitute, for dry, and powdered pumice stone and water, for wet rushes.

Tripoli, is an earth much used in Europe for polishing, after rushes or pumice stone have been used; we have seen specimens of American earth which possessed all its useful properties; rotten stone is most commonly employed, and answers very well; it ought, however, to be carefully washed

The mode of making gold lacker, and lac varnishes generally, we have heretofore given. What is meant by gold coloured oil varnish, we know not, it is easy, however, to give to white copal varnish, either a red, yellow, or orange tinge, but we should prefer a colourless varnish, as we think it bad taste to alter the beautiful colour of gold, as it exists in the leaf.

Amber varnish we have never used; for most purposes it is inferior to copal, but as a ground for gilding on, it may be superior; the mode of preparing it we shall hereafter describe.

Where work requires much rubbing down, many coats of colour are necessary, but in most instances they may be much less numerous, than directed in the preceding article; in metal they cannot be needed, and in wood, much depends upon the closeness of its grain, and the truth with which it is worked.

A new method of Softening Cast Iron.

To the Editor.

Sir—Having received both amusement and instruction from your valuable journal, I am induced to communicate what appears to me to be a very useful discovery. It is well known, that in casting small articles of iron, the metal will be sometimes so hard, as to resist the file, and all other tools, and is therefore useless; if, however, you take the article, and make it as hot as it will bear, without injury, and put on it a small portion of *brown* sugar, the sugar will spread itself rapidly and curiously, over the iron, will penetrate, and render it as soft as the softest malleable iron, and of course, allow it to be cut, or filed. I am told, that common salt, or borax, will act on the iron in the same way, but not so thoroughly. I have seen the experiment tried on a piece of casting, about eight inches in diameter, and ¾ inch thick; only half the iron was highly heated, and the sugar, 2 oz., applied to the heated part; the sugar appeared to go quite through this part of the iron, altering its colour and texture, and making it quite soft; while the other half remained white, hard, and incapable of being wrought. I claim not the merit of the discovery, the fact has been known to a few workmen here, for some months, and the information is, of course, extending; that it may have wider circulation, is the wish of

Yours, &c.

Boston, August 25th, 1827. A Subscriber.

Remarks by the Editor.—We have published the foregoing as we received it; the writer speaks with confidence of the result of the process, and this is the only circumstance which has induced us to insert it. The softening of hard cast iron is, in general, effected either by the addition, or abstraction, of carbon; we do not see how either can be produced by the action of sugar, in the way described: had time and convenience allowed, we would have tried the experiment ourselves; should others do so, we shall be glad to hear the result. Our doubts rest upon theoretical grounds; but should facts be against us we give up our theory without regret.

For the Franklin Journal.

Some account of the rise, progress, and present state, of the Union Canal, of the state of Pennsylvania.

One of the first objects of public improvement which claimed attention in Pennsylvania, was the opening of a communication by water, between the Susquehanna and Schuylkill. More than 50 years ago, surveys were made under the authority of the legislature, in order to ascertain the best route for the purpose; and nearly 36 years have elapsed since Robert Morris, David Rittenhouse, and other patriotic and spirited individuals, associated and commenced the SCHUYLKILL AND SUSQUEHANNA CANAL, upon what was then deemed the most eligible ground. A very large sum was expended upon the work, but from the want of capital in the country, and, more especially, from the inveterate prejudices existing against the undertaking, which was the first of the kind in the United States, its abandonment became inevitable, and the expenditure proved, almost, a total loss.

The project was subsequently revived under the name of the UNION CANAL, by the praiseworthy industry of the late Mr. Paleski, but it was not until the year 1821, that efficient means were provided to give reasonable assurance of its accomplishment. From that period, the work has been carried on with vigour and perseverance, and its completion being near at hand, the following particulars relative to it will be found interesting.

The Union Canal begins, on its eastern end, in the works of the *Schuylkill Navigation*, about two miles below the town of Reading; ascends along the western shore of the Schuylkill to the valley of the Tulpehochen, and passes up that valley to the east end of the summit, within five miles of Lebanon, rising 311 feet by locks of different lifts, from four and a half, to eight feet each. The summit level extends six miles 78 chains, part of which is by a tunnel 729 feet in length, 18 feet wide, and 14 feet in height, which opens into the valley of Clark's Creek, along which it descends to the Swatara river, and continuing along the valley of the last mentioned stream, it terminates at Middletown on the Susquehanna, where it joins the east end of the great Pennsylvania canal. The descent from the summit, to the Pennsylvania canal, is 192½ feet, which is overcome by thirty-seven locks of various lifts.

The whole length of the canal is about 79 miles, exclusive of the navigable feeder of seven miles, which extends up the Swatara, towards the extensive and valuable coal beds on the sources of that stream. The excavation of the trunk of the canal, much of which is through solid rock, is entirely finished; the tunnel which surpasses in length any in the United States,—two reservoirs at the summit containing 12,000,000 of cubic feet of water,—a dam across the Schuylkill at Reading, which gives a fine harbour to that flourishing town, and two dams across the Swatara, for the purpose of feeding the canal, are completed. All the other works, usually incident to such an undertaking, excepting the toll-houses and fences, are likewise finished, and consist of 43 waste wiers—49 culverts—135 road and farm bridges—12 aqueducts, one of which is 276 feet in length, and another 175 feet;—two guard locks of wood, and 92 lift locks of cut stone, principally cemented with Pennsylvania water lime. Besides the particulars here enumerated, solid protecting walls have been constructed, to the extent of fourteen miles in length, in situations where the pressure of contiguous streams is occasionally dangerous; a feeder upwards of four miles long, and lined throughout with plank, has been made, and extensive works, similar to those at Fair Mount, are erected on the Swatara, for supplying water to the summit. One of the wheels of this establishment is thirty-six feet in diameter, and works two double forcing pumps, at the same time. The other wheel is twenty-one feet five inches, in diameter, and works two pumps in the same way. In addition to these, the company are erecting two steam engines of one hundred horse power each, to be worked with anthracite coal, and to be used for raising water in case of necessity.

The parts of the canal east and west of the summit, have been navigated for several months past, and the water was recently let into the summit so that one boat crossed it, and passed from the Schuylkill to the Susquehanna; but this part of the canal, being through a lime-stone region, was found too porous to be relied upon. In consequence of this difficulty, the company are now engaged in planking the parts which appear to require it, and in puddling some parts anew.* These measures and some parts of the machinery for elevating the water, are all that remain unfinished, and it is understood that the company look forward, with confidence, to the middle of November, as the period for the canal to be put into full operation.

The Union Canal is 24 feet wide at bottom, has 4 feet depth of water, and 36 feet water surface. The towing path is ten feet wide, and is raised eighteen inches above the top water line. The locks are 8½ feet wide, and 75 feet long, between the gates, and are adapted to pass boats of 25 tons.

We are aware that much exception is taken to the width of the locks upon this canal, which are according to what is termed the "small system" of navigation; but when it is considered that locks of this size, if fully employed, are capable of passing nearly 4000 tons in each 24 hours, and that in England, the most useful and important, as well as the most lucrative canals, have locks of even a smaller size, we cannot but conclude that the day must be very remote when the trade of Pennsylvania will be greater than can be passed by the locks of this canal.

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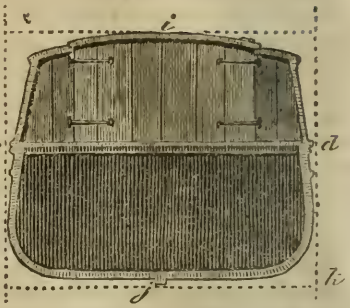
* Planking is by no means an unusual expedient; it has been frequently resorted to in England, and has been found necessary upon several parts of the New York and Schuylkill canals.

The foregoing account of the Union Canal, although not official, is derived from a source upon which entire reliance may be placed. We annex a description and engraving of the boats used upon this canal. The cross section, fig. 1, in the margin, is on a scale of one-fifth of an inch to the foot; the side, and deck views, figs. 2 and 3, one-eighth of an inch.

FIG. 1.



These boats are of 25 tons burden, and their dimensions are as follow:—

Length from	*a* to *b*	67 feet.
Width out to out	*c* to *d*	8 feet 3 inches.
Length of stern deck	*h* to *b*	5 feet.
Length of bow deck	*a* to *g*	9 feet.
Length of covering	*g* to *h*	51 feet 6 inches
Greatest width inside in the clear,		7 feet 6 inches.
Width in the clear at the gunnel,		7 feet 3 inches
Depth inside in the clear from the floor to the cover,		6 feet.
Depth out to out, from the top of the gunnel to the bottom of the keel	*d* to *k*	4 feet.
Depth from the gunnel to the keel inside,		3 feet 6 inches.
Forward hatch,		5 feet by 4 feet
Middle hatch,		5 feet by 6 feet.
Stern hatch,		4 feet by 4 feet.

A boat of the above description, loaded with 25 tons, will draw 3 feet of water, and will require one horse, and the attendance of one man and one boy. Where coal or other articles not liable to be injured by wet, are to be carried, the cover will not be necessary, and of course, the sides will not be carried higher than *c d* in the draught of the cross section.

Fig. 4 exhibits the canal boats mentioned by Mr. James Stott, in his communication, p. 117, showing how they pass along the canal, and through the locks. They have been long used to advantage, on the late duke of Bridgewater's Canal, from his coal works in Worsley to Manchester, and upon several other canals in England, for a series of years; and are considered as well adapted for the navigation from Mount Carbon, and for coal, and other boats on the Union Canal; as may be seen by reference to Mr. Stott's paper.

The gangways 1, 1, 1, 1, and the stages, 2, 2, (for the horses while crossing at the dams) are only temporary, and are removed while loading and unloading the boats. The boats are chained together in the locks; one man can manage them with ease; the boy, who drives the horse, lets the water into the lock, &c.

FIG. 2.

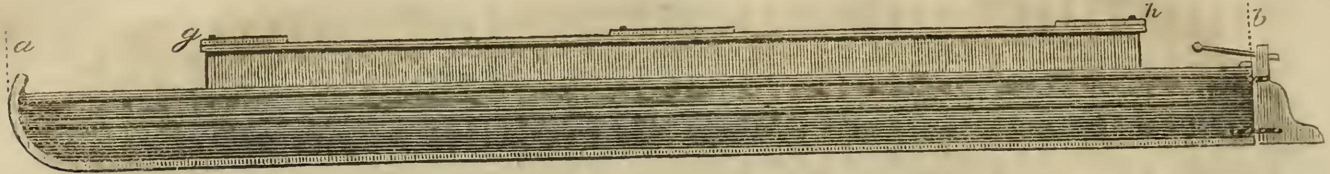


FIG. 3.

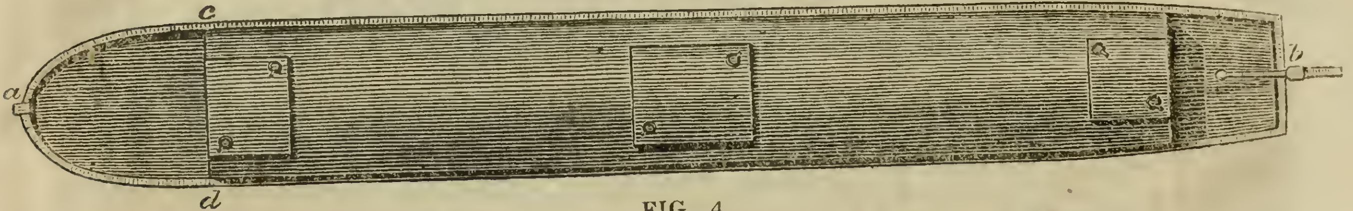
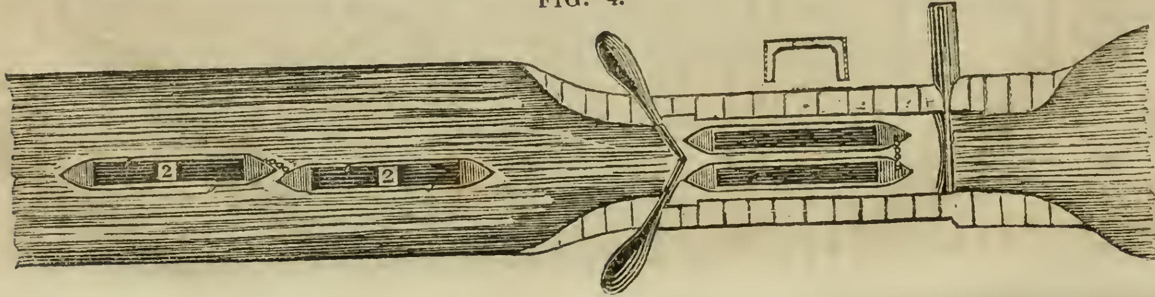


FIG. 4.



FOR THE FRANKLIN JOURNAL.

On a mode of conducting the transportation, on railways, and arranging the passing places, to avoid the necessity of a double set of tracks.

A CONSIDERATION of great importance in forming a railway, is the provision which must be made for carriages, moving in opposite directions, to pass each other. In canals, no provision of this kind is required, as a canal must, necessarily, to insure the banks from being washed away by the disturbance of the water, and to bring the resistance to the traction within proper limits, be sufficiently wide to permit two boats to pass abreast, every where upon the levels.

With a railway, on the contrary, each carriage occupies the whole of one set of tracks, and to enable another carriage to pass it, resort must be had to a second set of tracks. These may be formed through the whole course of the line, or through parts of the line, at short intervals; the carriages passing from one branch to the other by turning platforms or other contrivances, which it is not my purpose now to examine. It may be observed, however, that no mode of forming these, that is, of uniting the branches to the main tracks, has yet been devised, not manifestly liable to derangement, so as, in some degree, to endanger the safety of the carriages. This, together with their cost, has prevented judicious engineers from recommending them to be placed nearer than one quarter of a mile from each other. Hence if long railways, such as are already projected in various parts of our country, to answer the general purposes of transportation, be made to consist of single sets of tracks, with passing places at intervals, only, it must be evident that if the transportation be conducted in the usual method, it must be constantly interrupted by the carriages meeting at the intervals between the passing places.

To form an idea of the delays and vexations which would arise on a railway of this kind, for the transportation between a great agricultural district and the sea board, let us suppose one of our great roads to be walled up on both sides, leaving merely width of way for a single carriage, between the walls, except at intervals of a quarter of a mile; at which points, only, a sufficient width should be provided for carriages to pass each other. Would a person enter, between these straight walls, with any confidence that he should arrive at the passing place without meeting some other carriage and being obliged to return, himself, or compel the other carriage to retreat before him, to the next passing place? The question is answered almost instinctively. Yet the difficulty of passing in opposite directions, on such a road, would be no greater than that to which carriages would be subjected on a railway, constructed in the manner above described. A carriage, on a railway, can no more leave its proper tracks, than it can pass through a wall of iron. The cases, so far as passing is concerned, are precisely similar.

Mr. Tredgold has shown that it can never be expedient to form a railway unless there be an assurance of 100 tons, to pass over it, every day, as the transportation of a less quantity than this, taking the interest on the cost of the railway as fairly chargeable to the expense of transportation, can be performed for about the same price on common roads. To enable the proprietors of a railway, therefore, to fix the tolls at so low a rate that the public may derive a clear and decided benefit from its formation, will require a transportation of 200 tons a day, on the average of the year. But as this would be constantly fluctuating, it must sometimes happen that, in the busy seasons, it would be necessary to carry 500 or 600 tons a day. To carry 500 tons would require about 72 horses; allowing 7 tons to a horse, besides the weight of the carriages. As these would be divided equally in the two directions, let us suppose 36 horses, with their trains of wagons, to pass, in one direction, at unequal intervals, any given point on a railway in 24 hours. A carriage moving, at the same velocity in an opposite direction, must meet them in 12 hours; and this meeting, if the distances of the trains, from each other, were determined altogether by chance, would be, at an average of 1-8th of a mile from a passing place; taking the passing places to be 1-4th of a mile asunder. Then, the velocity of carriages, laoded thus heavily, being 3 miles an hour, the delay at each meeting, for the approaching carriage to arrive at the passing place, must be 2 1-2 minutes; and as the obligation to wait would fall, indiscriminately, on carriages in either direction, it is a fair presumption that the single carriage, which I suppose to be passing in an opposite direction to the 36 other trains, will be obliged to wait 18 times in the 36 meetings. The delay, therefore, from this cause, would be 45 minutes. It would likewise require, at least a minute, on an average, to clear and arrange the turning branches at each of the 36 meetings, making a total delay of about 1 hour and 21 minutes, in a distance which would otherwise have been passed in 12 hours. The hinderance to a single carriage, or the train of carriages drawn by a single horse, as here stated, must clearly happen to every carriage passing, at that time, on the railway. Nor is this all, for the different velocities of the carriages, making it necessary for some to pass others, although going in the same direction, would be another fruitful source of confusion and delay. Great as this view of the circumstances of transportation, on a single set of tracks, shows the difficulties attending it, practice will be far from showing those difficulties to be less. Indeed when we add to the actual delay, the necessity which the carriers will be under, to watch for each other, to send avant couriers to see that the next defile is passable (thus making it necessary to confine their journeys to broad day light;) it would seem that the vexations and delays that all this would occasion, must detract very much from the usefulness of this means of transportation.

To avoid the difficulties above stated, and various others, two entire sets of tracks have been provided to most of the larger railways of Great Britain. "They commonly make two sets of tracks," says Dupin, *Force commercial, tome* 1, p. 154, "side by side, one for the carriages to go, and the other for them to return;" and to show that this is thought by engineers a judicious and necessary practice, I may cite the following from the Edinburgh Encyclopedia, No. 31, p. 307. "In laying out a public railway, a breadth of not less than twenty feet should always be contemplated, so as to admit of two entire set of tracks, with the necessary sides, paths and drains. In a private road with one set of tracks, a space of twelve feet in breadth may be found sufficient; but in this case it is generally necessary to make provision for about four passing places in each mile. But this description of road should seldom be resorted to for a public railway, against which the inconvenience of the heavy drag at the turns of the passing places, and the frequent stoppage of the wagons, should prove sufficient objections."

But the formation of even a double set of tracks, is not sufficient for a great railway, on which it is every way desirable to carry passengers, as well as freight, to run coaches as well as wagons; the latter, from their heavier loads, going, necessarily, much slower than the former. The double tracks provide perfectly for the opposite directions, but from the higher velocity of the coaches, they will occasionally overtake, and must pass the wagons. Branches from one set of tracks to the other must be made for this purpose; and as these can be only at fixed points, the same interruption, to the free passage of the coaches, will, in a more limited degree, occur, that I have before enumerated as certain to happen on a single set of tracks, used by carriages passing in opposite directions. Taking the example of a railway of 100 miles in length, and supposing 36 trains of wagons to enter upon each set of tracks in a day, and to travel $66\frac{2}{3}$ miles, or 3 miles an hour, exclusive of stops for changing horses; we have the equivalent of 54 such trains upon the whole course of such set of tracks, at one time. The velocity of these trains of wagons being 3 miles an hour; a coach going 9 miles an hour, must pass 36 of these trains in the course of its route, or in 12 hours; allowing one hour for necessary stops. With passing places at each quarter of a mile, a coach would be obliged to check its speed to conform to that of the wagons, 36 times a day, and to travel, upon an average, one eighth of a mile, each time, at the rate of 3 miles an hour. This, if not an evil of such magnitude as that before stated, as inevitable to passing in opposite directions on a single set of tracks, must yet appear as a vexation which it would be exceedingly desirable to avoid.

I have been thus particular in stating the conditions under which transportation, of all kinds, upon railways is practised, for the purpose of proposing a mode of conducting it which does not appear to have been acted upon systematically in England, and which would seem to obviate the difficulties I have enumerated, without the cost of a double set of tracks, or even of passing places, except at distances of several miles.

The method I propose, is to use a single set of tracks, and simply to confine the entrance of the carriages, upon their routes, to certain fixed periods, and to prescribe to them certain velocities. By this means, the exact places of meeting could be determined, and proper provision made for passing.

Take an example of a railway 100 miles long, and suppose that coaches, to travel 9 miles an hour, and wagons, to go 3 miles, enter upon their journeys, at both ends of the railway, after intervals of 12 hours only. The wagons in one direction would meet those of an opposite direction, at the distances of $16\frac{2}{3}$, $33\frac{1}{3}$, 50, $66\frac{2}{3}$ and $83\frac{1}{2}$ miles, allowing always for necessary stops, from either end of the railway. The coaches would meet the opposite coaches, midway, and they would meet trains of wagons at the distances of 25 and 75 miles from either end of the railway. The number of passing places, therefore, would be eight in 100 miles, and if the velocities and times were accurately conformed to, each carriage would be subjected to a hinderance of 8 minutes only, to clear and adjust the turning branches. There can be little doubt, that the carriages could be made to arrive at the passing places, within a minute of the fixed time. But as the passing places would fall at distances proper for changing horses, 10 or 15 minutes might be allowed for a belated train to arrive. A longer time than this would, probably, rarely, if ever, be necessary, unless on the occurrence of some disaster to the railway, such as would interrupt the transportation, though conducted in any other way.

It must be necessary, to any general railway, to form lateral branches, to pass through the country in various directions. Conformably to the system here proposed, the time of entering from these, upon the main track, should coincide with the arrival of the regular trains of carriages, of similar velocity, at the junction of the branches with the main tracks. This arrangement would be very simple, and would, apparently, occasion neither confusion nor delay.

For the purpose of rendering the proposed method clearly understood, I have assumed certain numerical velocities and intervals between the periods of starting. But these would, of course, be made to suit the circumstances of the route. A third velocity, between that of the coaches and wagons, might be assigned, should the public convenience require it. So, also, on parts of the railway which should deviate much from a level, the passing places should be arranged, in distance, to permit the descending carriages to travel with a higher velocity than the ascending.

The advantages of conducting transportation, on a single set of tracks, by this method, over that of suffering the carriages to pass at all times, and with all possible velocities, will I think, be evident, on a fair and careful examination. It is not, perhaps, too much to assume, that transportation could be conducted with as few vexations and hinderances, by this method, on a single set of tracks, as it would be by a double set, letting the carriages enter at all times, considering the difficulties, which would arise, from the various velocities with which they would perform their journeys. Under this view, the saving would nearly equal the cost of an entire set of tracks.

It may be assumed, by some, that it would be a great convenience to travellers, to be able to commence their journeys, and to traders, to send their goods, at all times. A little reflection will show this to be of very small moment. When we now undertake a journey, we find no difficulty in making our time of commencing it, to conform to the period fixed for the starting of the coach, or the steam-boat, and for sending goods, we could make our arrangements to conform, in the same way, without any inconvenience. It would, in truth, be a great advantage, peculiar to this system, that the loads of produce would arrive at the destined market at certain known periods. This would enable the traders, of all kinds, to be in the market at the time, to conclude their bargains at once, and be free to manage their other concerns. Amongst other incidental advantages, of this method, would be that of repairing the railway conveniently, and without interrupting the transportation; for as there would be long intervals of time, when no carriages would pass any point requiring repairs, the rails could be taken up, or any work performed, which would, from its nature, render the railway impassable. Again, the drivers and attendants on the long train of carriages, which would thus be brought together, would, in case of accident, insure immediate assistance to repair any damage, or to remove a broken carriage from the railway, if necessary, to provide for the seasonable arrival of the rest.

D. T.

August 22, 1827.

Description of a method of testing the quickness of Gunpowder. By Joshua Shaw, Esq.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Encouraged by your publication of my former remarks upon gunpowder, I am induced to offer some further observations on the same subject. Although much has been said upon the property of quickness in gunpowder, I am not aware that any accurate mode of testing it, has ever been offered to the public. The mode mentioned in your number for July, as communicated by captain Baird to the author of the Shooter's Manual, is not to be depended on; the inequality of a loose train of powder, however carefully laid, and the liability of the eye to be deceived, amidst the volume of smoke which accompanies the combustion, are unavoidable sources of error.

I have before advocated the opinion, that since the general introduction of the percussion gun, quickness is a property in powder, much less desirable than formerly, as regards the sportsman; but in a military point of view, and as long as the match, or partlight, shall remain in use, this property will be of great importance; it is more particularly so in national armed vessels, in which the undulations produced by the motion of the waves, are every moment shifting the position of the guns, and consequently the time required for slow powder to burn through the depth of the touch-hole, would render the firing uncertain.

In mere trials of skill, when the mind is at liberty, a tolerable calculation can be made, to meet these variations; but, I presume, that, in the heat and hurry of an engagement, few persons are so collected, as to make them with equal certainty; under these circumstances, therefore, quickness becomes all important, and a positive mode of testing it, must be acceptable to those who superintend this department of the public service, as well as to those who manufacture the article.

My experiments were made with a common fowling piece; this was lashed firmly in a horizontal position, at the height of about five feet from the ground; when loaded, an equal quantity of each kind of powder was used, and the balls carefully fitted to the calibre. At about three yards from the muzzle of the gun, a target was placed, which consisted of a frame made of pine, and placed vertically; this frame was furnished with grooves, and in these, a pannel was made to slide very freely; to one end of the pannel, a line was attached, which passed over a pulley, at one end of the frame, so that the pannel might be drawn from one end to the other, along the grooves, by means of a weight, suspended by the line. On allowing this weight to act, the pannel moved with great velocity, particularly by the time it had travelled three or four feet, at which period, and just as the foremost part of the pannel came in a line with the muzzle of the gun, a button was contrived to strike a wire connected with the trigger, and instantaneously fired the piece. To ascertain the quickness of the powder, it was only necessary to observe how far the pannel had traversed from the point where it first came in a line with the gun, until the ball passed through it.

I constructed this apparatus in the year 1814; my principal object was to test the advantages afforded by using, with the percussion gun, the *copper caps*, or *primers*, which I had then invented. My first experiment was in firing, alternately, at the sliding pannel, or target, with the flint, and the percussion gun. With the latter, it traversed only 2¼ inches, the ball breaking in at the same hole in several successive shots. With the flint lock, it traversed from nine to eleven inches. I next tried in the flint lock gun the comparative difference of powder, from different manufacturers. With Hervey's, the pannel traversed only eight inches; and with the slowest I could procure, thirteen inches. With Pigou's, from nine to eleven inches, as before stated.

I next tried the slowest against the quickest, in the percussion gun, and was surprised to find how nearly they approached each other. With the quickest, the pannel traversed 2 inches; with the slowest, three inches; from this I drew the conclusion that the slowest powder was much the safest, in the percussion gun; and I found that, when good, it was equally clean. With respect to some other advantages which the percussion gun possesses over the flint lock gun, and which I had intended to notice, I find by your last number, that I have been anticipated by Mr. Samuel Nock, of London, who is nephew to the Mr. Nock who invented the first patent breech.

Before closing this article, I wish to call the attention of the public, and more particularly of those concerned in the national marine, to the great advantages which may be derived by some simple application of the percussion priming to heavy guns, used at sea. Where national interest and honour are at stake, it surely becomes the duty of those in responsible situations, not to neglect any means which may tend to their promotion.

I have recently made experiments with a new kind of wadding, and have succeeded in producing some important results, which I propose to communicate, at an early day.

Yours, &c.

JOSHUA SHAW.

Philadelphia, Sept. 15, 1827.

On Dying with Prussian Blue.

In p. 57, of our first volume, we gave a process for dying with Prussian blue, for which a patent had been obtained in England. This, according to the method there described, is effected by dissolving the prussiate of iron, *(Prussian blue)* in muriatic acid, and using a mordant of alum. A different method of using the same material has been proposed in France, by M. Raymond, professor of chemistry at Lyons, and has been published in the *Journal des Connoissances:* by this valuable process, it is said that a brilliant and permanent colour is produced; more bright, and equally deep, with those obtained from indigo, whilst it will also furnish a sky-blue, not attainable from that substance, which is likewise more costly.

To dye silk of a Raymond blue, it is to be cleansed in a large quantity of water, after the usual boiling with soap; it is then to be immersed in a solution of persulphate of iron, (that is, of that kind of copperas, which is of a dark green colour,) the oxide of which will combine with the silk; the greater or less intensity of the shade of yellow which the silk acquires, will furnish the means of judging when a proper quantity of the ferruginous solution has been absorbed; after which it is to be rinsed with great care, to remove all the free acid; the silk is then to be immersed in a bath of prussiate of potash, acidulated by sulphuric acid. In a few minutes the dying will be completed; when this is effected, it must be rinsed in clear water, and brightened with purified urine, diluted with a large portion of water, into which is occasionally thrown a small portion of acetic acid, to guard against a too powerful action of the alkali.

The only difficulty which has yet been experienced in dying with Prussian blue, has been to obtain, at will, a regular gradation of shades, between the most intense blue, and a perfect white. M. Raymond, jun. has sent to the society for the encouragement of arts, patterns of every shade obtainable from indigo; but it has not yet been proved that the process is applicable in the large way.

M. Chevreul has recently read to the Institute, a memoir upon a process remarkable for its simplicity, by which he has lately obtained a perfect gradation in the shades of colour dyed by Prussian blue, which are at the same time, more permanent, and more beautiful than those from indigo. This chemist, after repeating the fruitless attempts of his predecessors, is convinced, that from indigo alone, it is impossible to obtain the various shades of pure blue, the materials employed with the indigo changing the colour, so as to incline it, more or less, to a purplish or greenish hue.

The following is the method pursued by M. Chevreul in graduating the shades from Prussian blue: he impregnates each of the different parcels of silk to be dyed, with different proportions of the oxide of iron, by immersing them in solutions, the strength of which has been previously regulated. For the deeper tones of colour, he employs the acetate, and for the others, the muriate or sulphate; after having properly rinsed each of the parcels, they are dipped into distinct vessels, or baths of the prussiate of potash, the proportion of which has been made to correspond with the quantity of oxide of iron previously united to each portion of silk. By these precautions he obtains all the desired shades; those, however, which are light, are apt to have a greenish hue; but M. Chevreul found, that on washing them sufficiently in river water, the blue shade was obtained in perfect purity. When the washing did not completely produce this effect, a very weak solution of muriatic acid, was found to remove the yellow matter which deteriorated the blue, and produced the tinge of green.

Method of packing seeds for transportation, so that they may retain their vegetative property.

The lovers of plants, or those who wish to have seeds transported to distant countries, ought to observe the precautions which follow, in order that the seeds may germinate, when they have been sown. The means of effecting this, which we are about to make known, are those which have been followed by that distinguished botanist M. Soulange Bodin, who has had long experience in this business.

All seeds intended for transportation, should be collected in a state of perfect maturity. The finer seeds may be enclosed in good paper bags, but those which are larger, must be placed, in layers, in very dry sand, and the whole packed in air tight vessels. The stratification in dry sand, is a precaution which alone would preserve their germinating property for many years, and during the longest voyages. Saw dust is also a good article, but it is necessary to take the precaution of placing it in an oven, as we do bran, when we wish to purify it from mites, or from the eggs of other insects. Oleaginous seeds, which are liable soon to become rancid, such as those of the coffee plant, the oak, nut trees, the tea tree, &c. require, when stratified, to be kept with great care separate from each other, in sand which is very fine, and very dry. Those which are of a middle size, may be sent in their pericarps, enclosed air tight in small cups, or pots, by covers of glass, fixed on with putty; or of wood or cork, imbedded in melted wax, or, which is better, in melted pitch.

Juicy seeds must be separated from each other, as contact would, sooner or later, inevitably cause a fermentation which would destroy them. Roxburg dips them into a solution of gum arabic; this, as it hardens, forms a coat which defends them against every principle of destruction, and enables him to transmit them from the Coromandel coast, to Europe, without undergoing the slightest change.

With respect to bulbous roots, and other plants with roots, which always require a length of from two to three feet in their shoots, or slips, it is best to place them either in earth, taken from the spot where the plant vegetates freely, or in some other earth well divided and mixed, and rather too dry, than too moist; the mould formed of the rotten trunks of trees is very good for the purpose; but it is necessary to ascertain that it does not contain insects.

Vegetables treated in this way, have been brought by M. Perrottet from the South Sea, and have all lived. The whole may be inclosed in little wooden casks well hooped, and covered, inside and out, with a bituminous coating. So situated, seeds are unalterable; and when the vessels are well closed, neither insects, external air, moisture, or even heat, can gain admittance. It is above all things necessary (notwithstanding some ill founded theories) to be careful not to use fresh moss, or immersion in wax, or in pitch; plants sent in this way, from the torrid zone, to France, have arrived either decayed, or quite dried up. [*Journal des Connoissances.*

AMERICAN PATENTS.

Description of a machine called the Wheel-wright's Assistant, for the purpose of boring felloes and naves, or hubs, and of forming tenons; for which a patent had been obtained by John Setton of Pendleton, S. C., Feb. 1827.

We have not a drawing of Mr. Setton's machine, and to give a clear idea of a complex instrument by description alone, is a rare talent; from that furnished to us by the patentee, the object and utility of the apparatus will be evident, although its precise form may not be fully understood.

A frame, similar to that called the wheel-gallows, is made, for the purpose of securing the hub to be bored; the top piece of this frame is secured by screws of wood or iron, instead of the common key wedge, which allows it to be raised, or lowered, at pleasure. A bench and frame are placed at right angles with that upon which the hub is secured. Upon this, a carriage is made to traverse backwards and forwards, being confined in its place by ledges, rebates, or grooves; this carriage is about a foot long, and at the top of it is a perforation from end to end, to receive the shank of the augur, which is turned by means of a crank. The carriage is drawn forward by a weight attached to a line, and passing over a pulley, and when the hole is bored of a sufficient depth, a treadle serves to draw the carriage back. On the opposite side of the hub, the bench is continued, and supports a second carriage, similar to that described, but so inclined as to give, in boring, the intended dish to the wheel. Two persons may bore at the same time, on these opposite sides, and will be able to effect the whole in four minutes. The patent augur is the best, but other kinds may be used.

Before the hub is secured by the screws, it is raised to its place by square blocks; on the upper one, a plate of iron is fixed, marked so as to show the number of holes to be bored, and a tack is driven into the hub, to guide in turning it round to a proper distance. A pin passes through the centre of the nave, and blocks, to preserve it in its place. The holes in the felloes, to receive the spokes, and those in the ends for the dowells, are bored in the same way, there being such appendages as are proper for fixing them, for the purpose of boring with truth.

To cut the tenons, and shoulders, on the spokes, the wheel is put into the frame, and fastened, as for boring the nave; the tenon, or hollow augur, is put into the carriage; this is hollowed the exact size for the tenon, and the outer end is of cast-steel, formed for cutting in a proper manner. There are suitable contrivances for holding the spokes steady, and a stop when the boring is of the proper depth, so as to insure a true circle in the wheel.

This machine will lay off, and bore the nave; lay off, and bore the felloes, cut the tenon and shoulders on the spokes, more correctly, than can be done by measurement: the spokes are the stronger from being shouldered on both sides. With this machine, a good hand can make a wheel in five and a half hours, after being furnished with the nave, turned, and the spokes and felloes, in the rough.

Abstract of the specification of a patent obtained by Denison Olmsted, Esq., of New Haven, Connecticut, for the use of a new material for the manufacture of gas, for the purpose of illumination. June, 1827.

The material which I employ, and the use of which I claim as my discovery, is the seed of the cotton plant; this, after being dried, or roasted, for the purpose of expelling from it the watery particles, I put into a retort, or other recipient, similar to those used for the making of gas from coal, tar, oil, or other substances, in which it is heated to a degree sufficient to convert the oily matter into vapour; which vapour, before its escape from the recipient into the gasometer, is converted into a permanently elastic fluid, by being made to pass over an ignited metallic surface, in the way adopted in the making of gas from oil, or other substances.

In the conversion of the oily matter of the cotton seed, into gas, I do not specify any particular form of apparatus, that already in use being sufficient for this purpose; but I do claim as my exclusive right, the employment of cotton seed, for the production, by destructive distillation. of a permanently elastic, and highly illuminating gas: the same being my invention and discovery, and not heretofore practised or known.

D. O.

NOTICES.

The series of Essays on Bleaching, and that on Earthenware and Porcelain, will be completed in the present volume; for this purpose we are compelled to extend them a page or two beyond the limits that we ordinarily assign to our longest articles, which is six pages. Their merit, and the importance of the subjects on which they treat, must apologize for their length.

Some of our subscribers have expressed a wish that we would increase the number of our short articles; this wish shall be attended to in our future numbers, particularly as it will gratify a class whose interest we have at heart,—the mechanics.

In the preface to our last volume, we mentioned that a plan had been devised, which was likely to afford the means of increasing the embellishments and utility of our Journal; the present number may evince the success of this plan, and those which follow will bear the same testimony.

Air Furnace. In vol. ii. p. 298, we published the description, and gave figures, of White and Sowerby's patent air furnace. Three persons, at least, we know, have erected furnaces upon that plan; in each of these instances, the iron was fused with uncommon facility, but it chilled on the bed of the furnace, and could not be kept at a temperature to enable it to flow freely. From the account of the patentees, it answered well in their hands: can any of our readers point out the fault in structure, or in management, which has produce the failure with us?

New edition of back numbers.—The new edition of the third volume will be complete in a few days; immediately after which, the first number of the first volume, will be reprinted. Complete sets may then be had, and those subscribers who have not received all the numbers of the third volume, shall be supplied therewith.

THE

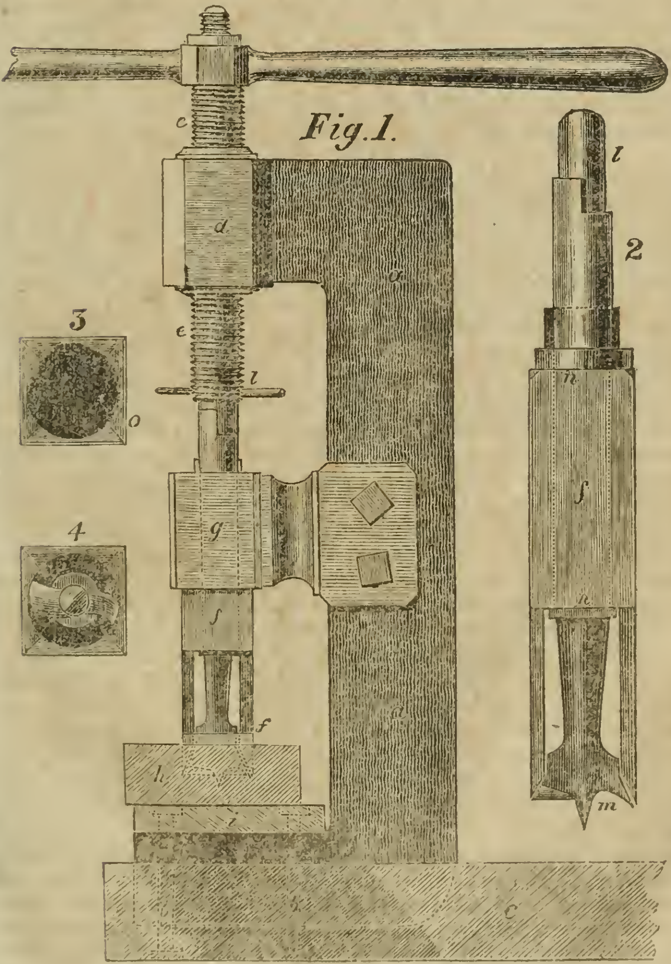
FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

NOVEMBER, 1827.



Hancock's machine for boring square holes and making mortices.

Hancock's machine for boring square holes and making mortices.

It has been the determination, and the uniform practice, of the editor of this Journal, to mete the most impartial justice, in his accounts of inventions, discoveries, or improvements; he has felt keenly, the numerous instances in which American inventions have been claimed, and appropriated, by foreigners, who have thus filched from us that which we value more highly than we do our purses. The most safe, as well as the most honourable proceeding in this, as in other cases, is to adopt, and to act upon, the motto of the Welch druids, "the truth against the world." Our readers will agree with us in this opinion, and we therefore offer no apology for publishing the following account, which renders it evident, that an instrument operating upon the principle of the American square auger, was in use in London, prior to the invention of the latter, in this country; still we have not the slightest doubt of the originality of the square auger, so far as the understanding of the American inventor was concerned.

In our Journal for October, 1826, we inserted the report of the committee of Inventions of the Franklin Institute, on an auger for boring square holes; the invention of which was claimed, by a Mr. H. Branch; we were, however, subsequently informed that Mr. Branch was only the purchaser of a right from the inventor, a gentleman of New York. This account was published in the English Journals, and the editor of the *Register of Arts and Sciences*, (London) in his number for May last, furnishes the subjoined description of a machine for a similar purpose, of which a cut, from the same work, appears on the opposite page.

"*a a*, fig. 1, is a strong iron frame or support, fixed by screw bolts, *b b*, to the work bench *c; d* is an octagonal iron socket containing a brass bush, which is tapped to receive the vertical screw, *e e;* to this screw is affixed, by a circular tenon and mortice, the square perforating instrument, *f*, which accurately fits and slides up and down through a rectangular hole, in a guide of brass, *g*, when the screw *e* is turned by the cross handle at top; so that a square incision is made by direct pressure downwards, at the same time that the revolving centre bit, *m*, cuts out a completely round hole, the chips rising up, and passing out at the two open sides of the square cutter: *h* is a piece of wood in the act of being bored, the dotted lines showing the depth to which the perforation has reached: the small piece of wood, *i*, is placed underneath, to prevent injury to the cutting tool by coming in contact with the cross iron plate, *k*; the bolts, *b b*, passing through *i* as well as *k*, secure both firmly to the bench, *c:* this figure is drawn to a scale of one-third the size of the original model in Mr. Hancock's manufactory.

"Fig. 2 exhibits the cutting part of the instrument separately, on an enlarged scale, with the lowermost portion in section: the tenon, *i*, is inserted into a cavity in the screw, *e*, fig. 1, and made fast by a cross pin which goes through both; by this arrangement the instruments may be readily exchanged for others of different dimensions; the lower extremity of this revolving piece, is formed into a centre bit, *m*, which, owing to the collars, *n n*, cannot ascend or descend without the square instrument, which accurately cuts out the angles beyond the range of the circular incision made by the former.

"The square cutting tool is made of a bar of steel, with a hole drilled out of the solid, in the manner shown by the end view, fig. 3, and the edges are then formed by filing and grinding them to the bevel, or angles, shown in section by fig. 2. Fig. 4 represents a similar view of the end of the instrument, but with the centre bit in its place.

"It will be readily perceived that a *square* tool, by repeating the incisions side, by side, close together, may be made to produce a mortice of the figure of *any* rectangular parallelogram, or, as workmen would say, an *oblong mortice*, of any length or breadth, larger than the instrument employed. The same effect may likewise be produced by a single operation; by arranging a series of centre bits, or circular cutters, side by side, with toothed wheels at their upper extremities, or axes, taking into one another so that they shall cut simultaneously, a single external angular cutter, embracing all the centre bits, would then suffice for that purpose.

"In like manner, any acute or obtuse-angled figure, any polygon, or any figure with curved sides, might be made of any size whatever.

"By the construction of the present model, it would be necessary in changing the tool, to change also the guide piece through which it slides. The screwing and unscrewing of the guides may, however, be avoided, by having tenons in the latter, of a uniform size, to fit into a mortice in the upright iron frame; and in manufactories where a great variety of mortices have to be made, we would, with submission, suggest another mode, in which the trouble of changing the guides would be still less: it is to have *a guide wheel*, turning horizontally on the upright bar, *a*, as its axis; on the circumference of the wheel should be made a series of apertures, corresponding with the form of the tools, and of the mortices, required. By this arrangement, indeed, most of the tools might be left in the guide wheel, ready to bring any one of them into action under the screw, by just turning the wheel round. Other modifications might be made to suit particular purposes, but we will not fatigue our readers by their explanation; being confident likewise, that the ingenious inventor would, if consulted, readily supply whatever adaptations might be required, with better arrangements than we can devise."

Immediately upon the publication of our account of the American square auger, Mr. Hancock, the inventor of the above described machine, invited the editor of the Register to witness its employment in his manufactory, where it had been used for a number of years: this invention has been presented to the public, Mr. Hancock having declined availing himself of a patent for his invention. Such machines are now manufactured for sale, in England. We insert the remarks of the editor, respecting the two instruments, as we deem them, in general, judicious, and correct.

"It does not appear to us that the employment of this machine would suit the private workman, unless it were in a branch of business where a great number of mortices were required of one size; in *manufactories*, however, where this is the case, its advantages would soon be felt, no skill being required in using it; a boy, a perfect novice, may, by its aid, execute the work quite as well as the experienced workman, and with his eyes shut. *Chair-makers* would, we think, find it a useful appendage to their workshops, for making their mortices with greater accuracy and rapidity, and consequently render the chairs more firm and durable; as most of their mortices have to be made in a slanting direction, a cradle should be attached to the machine for enabling them to change the direction of the perforations. We do not see why such a machine could not be successfully employed by *wheelwrights*, in making mortices in the naves of wheels for the reception of the spokes. In the large workshops of *carpenters and builders* it might be extensively used in despatching a great deal of heavy framing; and in such work, particularly the making of framed doors, the machine might be so constructed as to perform the offices both of a mortice borer, and of a cramp to draw the jointed parts of the work into close contact. *Millwrights* might save a great deal of time and labour by the use of the machine; in short, it would prove of great utility in every mechanical operation, in which many mortice holes are required.

"In Mr. Branch's instrument, it appears to us that the operation must be very unsteady when compared to that of Mr. Hancock; and we cannot conceive how the little central entering screw, can have sufficient power to draw the instrument into the wood, and consequently, that a great deal of inconvenient direct pressure must be given at the same time that it is forced round, laterally; and if the whole instrument does not perforate at every turn, a depth equal to the distance between the threads of the entering screw, the latter is of no assistance whatever. To work with two or more such square augers at a time, side by side, as mentioned in the American account, with workmanlike precision, and unaided by any other mechanical arrangement, would, we think, require the strength of a Hercules; that of an ordinary man, we feel assured, is unequal to it. Mr. Hancock's machine being a fixture, its motions are steadied and regulated by the revolutions of a screw, which passing through a fixed nut, confers upon it all the powers of the screw press, and it cannot fail to make its perforations with a certain and uniform progress.

"We ought not to close this account without mentioning Mr. Hancock's method of making the tenons to his mortices, the fitting of which is so accurate and tight, as, seemingly, to restore to the wood its former state of solidity. They are cut out by means of two circular saws in a lathe, placed apart, at a distance equal to that of the sides of the mortice: by this means, they must, obviously, be formed with great truth and facility."

It is a fact, that the American auger will only bore wood of a medium hardness; the small screw will not hold in the softer woods, such as cedar, and white pine, and the harder kinds of oak, hickory, &c. present too powerful a resistance to the entrance of the square socket. In boring the hubs, or naves, of wheels, &c. where two or three augers and sockets are used, the small screw is aided by pressure, made in different ways, against the head of the instrument, and has been found to answer perfectly well.

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. V. PROCESSES FOLLOWED IN BLEACHING.

Section IV.

7. *Souring.*—Since the time of Dr. Holme, who introduced sulphuric acid souring, there has been but little improvement made in this department of the Art of Bleaching. It always follows the boiling in alkaline leys, and is among the finishing processes. The goods are removed from the dash wheel to the souring vats, and exposed to the action of the sulphuric acid, in the same way as they are steeped at the commencement of the operation. It assists and expedites the process very much, for a reason which was formerly given in the directions for bucking, if the goods are dried before being put into the sour, but for this there is not always time. The acid is to be diluted till it can be taken with safety into the mouth, so as to indicate to the taste the strength of strong vinegar, or lemonade; or it may be tried by the hydrometer, and Mr. Parke's tables, the specific gravity being proportioned, and accommodated, to the fabric of the goods. The Irish bleachers use 100 parts of water, to dilute one part of sulphuric acid; the French at Mayence 60, to one, by measure. The same precaution is to be taken here, as in bucking, with regard to the equal mixture of the acid and the water with which it is diluted; for as the acid is poured into the water, and the former being twice the specific gravity of the latter, the acid will sink undiluted to the bottom, if care be not taken to agitate and mix it. Want of attention to this circumstance, was one of the causes which prevented the speedy introduction of this mode of souring, when it was proposed; for the bleachers being ignorant of the imperfect state of the mixture, fearlessly put in their goods, which were speedily corroded. The goods are usually suffered to remain in the sour for twelve hours; if they are put in, dry, a shorter period will be sufficient, and it will be farther expedited by having the water milk-warm, or even as warm as the hand can easily be held in it. It is of the utmost consequence to have the remains of the acid completely removed after the souring, because if the cloth is allowed to dry before washing, the condensation of the acid will infallibly corrode it. The less the goods are pressed in the vat, the more perfectly they will be exposed to the action of the acid; it was probably want of attention to this, which gave rise to prejudices against the use of acids. Whether they are sufficiently cleared of it, may be ascertained by applying the tongue, when the absence, or presence, of an acid will indicate the necessity for the continuance, or discontinuance, of the washing.—*(Dublin Report*, 1791.*)*

8. *Finishing Process.*—After souring, and a thorough washing, the goods are examined, to see whether the operations have been successful in bringing them to a pure white. For this purpose, as the perfection of the bleaching can be better judged of when they

are wet, the pieces are to be run through water, and passed from it over a roller, so gradually as to give the superintendent an opportunity of examining every inch of the surface. Cottons intended for calico printing, may be run once or twice through a madder copper, of the temperature of 180°, which will mark any part that may be imperfectly bleached. If any are found not to be fully white, they are returned to the workmen, to go through a second course of bucking, immersion, and souring. Those which are found to possess the requisite whiteness, are pressed clear of water, and a bluish cast given to them, to make the white look clearer. This is done in two ways: either by diffusing, in the usual way, a small quantity of fine indigo, through a hot, or cold, solution of white soap, and immersing the goods in it; or they may be immersed in a solution of white soap, without any kind of blue, while it still contains a small portion of the acid. If the latter is employed, the small portion of acid in the cloth, immediately exhibits, in the vat, a slight tinge of Berlin blue, arising from the particles of iron combined with the alkali of the soap, which tinge is distributed very equally on the whole piece. This method is liable to uncertainty from a nicety of management required for complete success, and only those, therefore, who have some experience should attempt it; but it is recommended by its economy. A sufficient quantity of the solution of indigo must be prepared for every portion of goods to be blued, that it may not be necessary to make additions to it during the process, otherwise different shades of blue would be produced. The goods should be plunged into it at the moment the colour is suspended, and they should be left no longer than is necessary for imbibing it. It is not easy to account for a fact observed by Des Charmes, that some pieces, after being taken out of the bleaching liquor, and having undergone an immersion in the sulphuric acid sours, still retain a sufficient quantity of muriatic acid (derived from the chlorine) to cause them to assume a yellowish tinge, after they had passed through an infusion of indigo. This tinge, indeed, is common to almost all goods which pass through any preparation of chlorine, but is commonly removed with ease, by crofting, souring, or immersion in the solution of soap. For the calendering, and the manipulations connected therewith, I refer to Des Charmes, as it does not fall within my plan.

9. *Epitome of all the processes.*—I shall now bring all the processes into one distinct view, giving Mr. Ramsay's account of the order, and number, of them employed in Glasgow, and in Ireland. A parcel, says he, of 360 pieces of linen of the sort called Britanicas, weighing 3600 lbs. are first steeped, then

1.	Bucked with	60 lb.	pearl-ashes,	washed,	crofted.
2.	Do.	80 lb.	Do.	Do.	Do.
3.	Do.	90 lb.	pot-ashes	Do.	Do.
4.	Do.	80 lb.	Do.	Do.	Do.
5.	Bucked with	80 lb.	pearl-ashes,	washed,	crofted.
6.	Do.	50 lb.	Do.	Do.	Do.
7.	Do.	70 lb.	Do.	Do.	Do.
8.	Do.	70 lb.	Do.	Do.	Do.

9. Soured one night in diluted sulphuric acid, and washed.
10. Bucked with 50 lb. pearl-ashes—washed—crofted.
11. Immersed in oxymuriate of pot-ash or lime twelve hours.
12. Boiled with 30 lb. pearl-ashes—washed—crofted.
13. Do. do. do. do. do.
14. Soured—washed—blued—mangled or calendered.

10. *Bleaching of Calicoes—Muslins—Hose—Thread, &c.*—In bleaching for Calico printing; the process is very similar to that we have already detailed; the chief difference lies in the number of the buckings, and the strength of the leys, as the colouring matter of cotton is much more soluble than that of linen;—and sometimes, when the weather is favourable for crofting, intermitting the immersions in the chlorine preparations. To remove, or destroy, the reddish hue arising from boiling printed cottons in madder decoctions, which prevents the printed colours appearing to advantage, the goods are usually boiled for some time, in bran and water, and then exposed to the air, by wet crofting. Mr. Grimshaw, of Belfast, in 1796, obtained a patent for clearing printed goods coming from the madder copper, by using the grains after brewing malt liquor, (Draff *Scotice)* instead of bran.—*(Rees' Cycl. Bleaching.)* In bleaching ginghams and pulicates, where part is woven coloured, and part white, the oxymuriate of potash is found to be the best agent, together with very dilute sours of sulphuric acid. No bucking is used, but the goods are gently boiled in a solution of soap, previous to immersion in the chlorine preparation. When the whites have been bleached before weaving, the goods are merely washed, and put into a sulphuric acid sour. The chief difference in bleaching thread—hose—night-caps, and other small articles, consists more in the manipulations, than in the chemical process, for which I refer to Pajot Des Charmes *passim*, for minute and practical directions, for wringing—folding—unravelling, &c. &c. For the Indian mode of Calico bleaching, see Dr. F. Buchanan's journey through the Mysore, vol. i. p. 223.

SECTION V.

11. *Steam Bleaching.*—The compressed steam of boiling alkaline leys, was, some time ago, recommended for the purposes of bleaching, by Chaptal, *(Chim. app. aux. Arts*, III. 100, and *Journ. de Physique pour* 1801): chiefly for cotton goods. They are continually, and repeatedly, immersed in an alkaline ley, made in the usual manner, and then exposed to the action of the vapour arising from the same ley, heated to 220° or 230° Fahr. By this means the French chemists, Chaptal and Delametherie, procured good whites, without injury to the fabric of the cloth, and without using any preparation of chlorine. They found that the resinous, and other colouring matters of the cloth, which are insoluble in a diluted ley of the temperature of boiling water, become soluble in a vapour of the same, when the heat is carried a few degrees farther. The immersion of the goods in the ley, and their subsequent exposure to its vapour, are successively repeated, till the goods become completely white.

Chaptal performed an extensive experiment on the same principle, in order to introduce it for domestic washing, *(see Ann. de Chim.* xxxviii. 291.) He washed by this method, with great success, 200 pairs of sheets belonging to the hotel Dieu at Paris. In giving an account of this, Mr. Parkes observes, that brown calicoes, which have only been *once* boiled, after having been all night in the whale-boiler, are often completely white, where they have been in immediate contact with the iron in the midst of the apparatus, while the other parts were almost unchanged. The process of steam bleaching, the same author remarks, will always be attended with danger, as the force of the steam, if the valves be overloaded, or deranged, may burst the apparatus. It seems to be but a slight modification of the French process, for which Mr. Turnbull of Bonhill has lately obtained a patent. *(See Repertory of Arts.)* He immerses his goods, either cotton or linen, in a hot solution of caustic alkali, and then exposes them to the vapour of simple water, when loaded with the alkali in which they have been immersed. The previous and subsequent processes are the same as in the ordinary mode, and the chief advantage of this plan, seems to be in the saving of alkali; much fewer baths of ley being necessary than in the common method, as the heated vapour increases the alkaline action. It does not, however, supersede the chlorine preparations, as good whites cannot *easily* be procured without one immersion in an oxymuriate. Slabs of stone, cramped with iron, are found the best apparatus for steam bleaching. More information on this subject may be had in *D'Orellie, Essais sur le Blanchiment.* M. Cadet, thinks that the rationale of this process consists in the alkali exercising over the oil, or the resin, of the cloth, a double attraction: first, directly with the constituent principles of the oil; and secondly, predisposing and favouring the combination of the oxygen of the atmosphere, with the oleaginous or resinous matters. This appears, he thinks, from the oil, of the soap, being, when decomposed by an acid, always more concrete, and more oxygenated than it was before. *(Ann. de Chim.* No. 131.*)*

12. *Paper Bleaching.*—The title which I have chosen for this section, comprehends two different processes: one for bleaching rags, and other materials, from which paper is at first fabricated; and another, for refabricating paper from old, written, or painted, papers. We are chiefly indebted to the French chemists for these processes, which may be seen in various parts of the Annales de Chimie, and in Des Charmes' Art of Bleaching. Rags, when gray, or coloured, are to be separated and ground in the paper-mill in the usual way, till brought to a sort of uniform consistence, having been previously macerated, according to their quantity and tenacity. The mass is then treated with an alkaline ley, similar to what has already been directed for piece goods. It is next treated with either of the preparations of chlorine, which is thought most convenient. I believe the oxymuriate of potash, which was lately the most common, has now given place, in Britain, to the oxymuriate of lime. If this immersion do not produce the desired effect, which does not often happen if the colours are tenacious, such as red and blue, let the treat-

ment with the alkaline leys be repeated, and follow it with another bath of the chlorine preparation. Then sour the whole in a bath of sulphuric acid, much diluted, and cold; for when hot, its action will be less effectual. Water is then to be run upon it, till it come off without colour, or indication of acidity. Black, is the most easily discharged colour, and will seldom require being treated with ley; one steep of sulphuric acid, and another of oxymuriate of lime, being commonly sufficient to produce a good white. The mass is then ready for being manufactured. In this manner may be bleached, at a trifling expense, and in a few hours, a sufficient quantity of materials for making as much paper as will print a large edition, of the largest work, in the English language. Old printed or written paper, again, is first to be sorted according to its quality, and all the yellow edges cut off by the bookbinder's plane. A cwt. of this paper is to be put, sheet by sheet, into vats sufficiently capacious, with 500 quarts of hot water. The whole is to be stirred for about an hour, and as much water gradually added as will rise about three inches above the paper, and to be left to macerate for four or five hours. It is then ground, coarsely, in the mill, and boiled in water for about an hour, taking care to add, before it begins to boil, thirteen quarts of caustic alkaline ley. After boiling, it is macerated in the ley for twelve hours, when it is pressed, and, if sufficiently white, is forthwith manufactured into paper, if not, the process is repeated. Written paper, may be bleached by sulphuric acid alone, and printed paper by alkaline or soap leys, but the above process is the most effectual, and the expense is exceedingly trifling. Paper which has been written, or printed, may even be bleached without destroying the leaves, by treating them with the same chemical agents, taking care to arrange the sheets, alternately, between cloths, in the same manner as the paper makers dispose their sheets of paper when delivered from the form. (*See Chaptal, Chim. app. aux Arts* III. 108. and *Ann. de Chim.* I. 69.)

SECTION VI.

13. *Straw Bleaching.*—Our milliners, not pleased with the yellow colour, which the straw of which hats are made, originally possesses, or urged by the all prevailing passion for novelty, have lately been desirous of obtaining white straw; and several attempts have been made to bleach this substance with the usual agents. Sulphuric acid has been found to succeed best in those incipient attempts, while the oxymuriates, and the simple chlorine gas, are said to injure the texture, and destroy the natural varnish, of the straw, which is its greatest beauty. It is probable, however, that this has proceeded from unskilful management, for in other departments of bleaching, the corrosive effects of the chlorine, when combined with earths or alkalies, and properly diluted, are found to be as easily prevented, as that of sulphuric acid, while its power of destroying a colour, is greatly superior.

14. *Silk Bleaching.*—In Hindostan, as we learn from Dr. F.

Buchanan, in his journey through the Mysore (vol. i. p. 223,) in order to bleach their silks, they take 5 seers (a seer is 4835 lbs.) of silk, either raw or in thread. 3 seers of *soulu*, or Indian pearl soda, and one and a half of quicklime, mixing the soda and lime with 4 or 5 seers of water. This is boiled for an hour, and the silk dipped into it, and afterwards dried. Then they take 3 seers of this silk, 3 seers of soulu, one dudu (6.47D ra.) of indigo, and 18 seers of water, and boil the whole for about two hours. The silk is to be washed in hot limpid water, and then dried. This process requires much care; as, if there be too little soda, the goods will be spoiled, and if they are boiled too little, a good white will not be produced.

The Chinese mode of bleaching the silk denominated Nankin, without boiling or ungumming it, is supposed to have been discovered by M. Baumé, who has given an elaborate memoir on the subject, *Jour. de Phys.* 1793. M. Baumé (loc. cit.) directs, to dispose six pounds of yellow, raw silk, in a stone-ware vessel, and to pour over it a mixture, previously made, of about forty-eight pints of spirit of wine, and twelve ounces of very pure muriatic acid, the whole being then covered up, and left to digest, till the liquor change from green, to yellowish brown. The liquid is then drawn off, and unmixed spirit of wine is poured upon the silk till it comes off colourless: it is then allowed to drain, or *seep*, as the Scotch bleachers would say, when it is ready for a repetition of the process. The second steeping continues longer than the first. The third maceration is made in pure spirit of wine, for a day, when it is drained, and sprinkled with water, to recover all the spirit; it is then washed clear of the acid by putting it in a woollen bag, and keeping it in a running stream for six hours. The water, and the muriatic acid, ought to be completely free from the nitric acid, otherwise the goods will be spoiled. Rigand found the process to be one half more speedy, when the vessels were exposed to the sun.

When the silk is to be deprived of its gum, the process is different. A ley of white soap is made, by boiling in water 30 lbs. of soap, for every 100 lbs. of silk intended to be bleached, and in this the silk is steeped till the gum is dissolved and separated. It is then put into bags of coarse cloth, and boiled in a similar ley for an hour. By these processes it loses 25 per cent. of its original weight. The silk is then thoroughly washed, and steeped in a hot ley, composed of a pound and a half of soap, and 90 gallons of water, with a small quantity of litmus and indigo diffused. After this, it is carried to the sulphuring room: two pounds of sulphur are sufficient for 100 lbs. of silk. When these processes are not sufficiently successful, it is washed with clear *hard* water and sulphured again. *(Des Charmes*, p. 294.*)*

15. *Wool Bleaching.*—Wool is commonly bleached by means of fumes arising from the slow combustion of sulphur; by which is meant, combustion in the atmosphere, in contradistinction to that of burning sulphur in oxygen gas, or with a mixture of nitre. *(See Parke's Chem. Ess.* iv. 154.*)* The former, Scheele has shown by luminous experiments, is the most effectual for bleaching wool. The

process has been known and practised these sixteen hundred years, as appears from Apuleins, *(De Asins Aurcs.* ix. 136,*)* who tells us of a man, that having had an illicit amour, was nearly suffocated in the house of a fuller by hiding under a wicker coop where cloth was hung to be whitened by the fumes of burning sulphur: "*Contigit vinainca cavca; gual lacineas circumates, suffusa candido fumo sulphuris inalbabat.*" It is even mentioned by Pliny *(Hist. Nat.* xxxv. 15.*)* to have been employed so early as the first century. The wool is first prepared according to the purposes for which it is intended, by treating it with leys composed of wine and water—or of solutions of soap. By this process, it is cleared of a great quantity of loose impurity, and grease, which is always found in it, wool often losing no less than 70 per cent. of its weight. The heat of the ley must be carefully attended to, as a high temperature is found to fix the unctuous matter, or yolk, of the wool. After washing, it is taken to the sulphur chamber, where it is exposed to the vapour, from five to twenty hours, according to circumstances. This is again washed, and then immersed in a bath composed of pure whiting and blue. It is then exposed a second time to the fumes of the sulphur, and washed with a solution of soap, which renders it of the proper whiteness. It is of importance to remark, that there should be no iron about the sulphur chamber, as, by becoming oxydized, it might spot the goods. The cloth, or wool, also, which has been sulphured, ought not to be laid immediately on wood, as the sulphur will dissolve the resin, or gum, of the wood, and produce stains. The final washing with soap, takes away the harshness of the wool, and the disagreeable odour left in it by the sulphur. This mode of bleaching, however, only whitens the surface of the goods, which has led recently to the employment of liquid sulphurous acid. The process of its application has not come to my knowledge. For farther information consult Pagot. *(Des Charmes,* 6. 28.*)*

16. *Wax Bleaching.*—According to Fourcroy, *(Syst. Connais. Chim.* x. 343.*)* wax derives its yellow colour from the fumes, and moisture, which proceed from the bodies of the bees in the hive, as well as from the colouring matter of the vegetables whence it is derived. This opinion seems to have been formed upon the erroneous notion that wax is derived immediately from the pollen; the falseness of which, the experiments of Hüberson, have completely exposed. It is a pure animal secretion. In order to bleach it, pieces of it are melted so as to fall upon a cylinder which is half dipped in cold water, from which, as it rolls, it is made, by a simple contrivance, to pass into this water. The wax is, by this means, formed into thin ribands, which are exposed to the sun and air upon cloths, till it acquires the requisite whiteness, when it is, improperly, called virgin wax. This is the account given by Fourcroy as the French method: Parke has copied it, nearly verbatim, as the method followed in England, *(see Syst. Connais. Chemique,* x. 343. and *Chem. Ess.* iv. 155.*)* We have a different account of the French mode in Des Charmes: The ribands of wax he directs to be exposed to the action

of water, impregnated with chlorine gas, which succeeds better than any of the oxymuriates.

We have, in the Annale de Chimie, (No. 131.,) a very curious account, given by M. Cadet, of the mode of bleaching the vegetable wax produced from the *Myrica cerifera* of America. It is effected by the sulphuric acid, or by chlorine; but as the wax does not sink in those fluids, means have to be invented to multiply the contact either by cutting the wax into slices, and sprinkling it with the liquids, or shutting it up, when sliced, in a cask into which they are then introduced. A speedier method would be to place the wax, cut into small pieces, in alternate strata with the oxymuriate of lime, leaving it in this state for some time, dry, and in contact. The salt and acidulous water are then to be decomposed by sulphuric acid, pouring in the water gradually, till no more muriatic gas be disengaged. Add then a large quantity of water, stir the mixture, and the insoluble sulphate of lime will fall to the bottom, while the bleached wax will float on the surface.

Essay on Earthenware and Porcelain.

[From Parke's Chemical Essays.]

(Continued from page 227.)

As the number of potters has increased very much, within the last 50 years, the competition has become so great, that every manufacturer is under the necessity of consulting economy, and of sometimes sacrificing the utility and goodness of the ware, for the sake, either of appearances, or of adopting the cheapest modes of manufacture that can be devised. To one of these causes, may be attributed the introduction of *bones* into the manufacture of porcelain. Of this article there is now so large a consumption in the Staffordshire potteries, that some of the great manufacturers have extensive rooms, which are used solely for the reception of bones. Animal bones are composed of lime and phosphoric acid, in different proportions, according to the age and species of the respective animals to which they belonged. These are either bought of the indigent bone-collectors in the country, and then burnt and ground by the potter, or they are purchased ready burnt and ground for use, directly from those who distil volatile alkali, or spirit of hartshorn. It is, however, generally known to the china manufacturers, that this article is injurious to the texture of the ware: its use, therefore, cannot be justified on any account whatever.

I allow that ground bones have the effect of rendering the goods very white, and also that they produce a transparent appearance; but I doubt whether this be a real transparency, or only a deception. Thus far, however, one may venture to assert, that the modern English porcelain, which has the usual proportion of bones in its composition, is of much less specific gravity than it ought to be,* and is very apt to crack with hot water. As the base of animal bones is phosphate of lime, it might be worth while for the potter who is determined to use bones, to try whether the *native* phosphate of lime* can be useful in making porcelain, and if phosphate of alumina may also be employed in this manufacture.

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* For the specific gravity of good porcelain, see Note, page 225.

In returning to the subject of glazing, it will be proper to state, that the common earthenware would be too porous, and many kinds of fluids would pass through it, were it not defended by an artificial covering of permanent glaze. It became necessary, therefore, to contrive a composition which should vitrify and flow in the fire, so as to cover these materials of earth with an entire coating of perfect glass.

Such a glaze having been found in a mixture of oxide of lead† and silica,‡ as mentioned above, a certain proportion of each of these, ground to an impalpable powder, is thrown into a tub of water, and stirred therein till the mixed powder becomes suspended, and uniformly dispersed throughout the fluid.

The glaze having been thus prepared, it is applied to the ware in the following manner. A workman to whom this duty belongs, receives the goods from a boy, who delivers them to him, one at a time; and as he receives each single piece, he dips it in the liquid, lets it drain for a moment, and then, placing it on a board standing beside him, he is ready to receive another piece, which he immerses in like manner.

It is in this way that the glaze is applied to all the various articles which are made of the common earthenware; and as it is only partially baked, or in the state of biscuit, when it is immersed in the glaze, a sufficient quantity attaches itself to the surface, which, when it has been fused, will form over it a complete covering of glass. This mixture has great fusibility, though silica alone does not melt in the focus of the most powerful burning mirror. Mr. Hare, however, fused it completely, by submitting it to the flame of a stream of mixed oxygen and hydrogen gases; and found that it formed, when cold, a kind of enamel.§

There are, however, strong objections to this mode of glazing pottery. The men who work in it for a considerable time, are apt to become paralytic, probably from the lead:‖ and where acids, which have the power of dissolving the lead, are employed in preparing condiments for our food, such a glaze must be extremely unwholesome.

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* A memoir by Hassenfratz "On the native phosphate of lime," may be seen in the *Annales de Chimie*, tome i. page 191. Likewise some "Remarks on phosphate of alumina, and on a mountain of calcareous phosphate," by Proust, in the same volume, page 196.

† The French potters, instead of an oxide of lead, use the common galena, or sulphuret of lead, for this purpose.

‡ Silica was formerly known by the name of the *vitrifiable* earth, because mixed with an alkali, it possesses the property of fusing into a transparent glass.

§ *Philosophical Magazine*, vol. xiv. page 304.

‖ Some directions for the prevention of this malady will be found in *The Chemical Catechism*, tenth edition, page 101.

Aware of the pernicious effects of lead, when taken into the stomach, M. Fourmy, an ingenious manufacturer at Paris, has prepared water-coolers, in which he has employed lava for the glaze, instead of the deleterious metallic covering, which is more commonly used for that purpose. Pumice-stone has also, as I understand, been used for covering earthenware, and with very good effect.

Some of the French potters, at the suggestion of Chaptal, have substituted common flint glass for lead, in their glazing, and have found it not only safer, but more economical. They grind broken flint glass to a fine powder, and when this is mixed with a due portion of clay and water, the goods are dipped into it, as our potters dip their ware.

The potters of Bristol, and Lambeth, glaze their stone ware with common salt. When the oven has acquired a certain temperature, the salt is cast in, and the vapours arising from it attach themselves to the goods, and completely cover them. The alkali of the salt probably combines with the silica of the ware, and forms a true glass upon their surfaces.

The English potters are, however, fond of using a glaze made with lead and silica, because, whatever the articles may be which are employed for this purpose, it is necessary to give them a heat sufficient to vitrify the materials, and convert them into a perfect glass; and when the best articles are made use of in forming a glaze, the heat which is employed must be very considerable; whereas, lead alone will readily fuse and form a glaze that may be finished at a very low heat indeed. This, however, if fused alone, would make a glaze too soft, and so extremely fusible, that it would be apt to run very much towards the lower parts of the ware, and leave the upper ones imperfectly covered.

Half a century ago our potters were so careless in their manner of applying the salt glaze to the stone wares of Staffordshire, that large importations were made from France and Holland, where the manufacture was better conducted; and had it not been for Mr. Wedgwood's timely invention of the Queen's ware, it is probable that the best part of the trade would long ago have been lost to this country.

A variety is sometimes given to the glaze, by mixing certain oxides of the metals, especially that of copper, or otherwise, the filings of copper; but this coloured glaze is generally applied only partially, and merely for goods of inferior quality. The edges of common plates are sometimes coloured by this method.*

It is about sixty years since the plain cream-coloured ware of Mr. Wedgwood was introduced. At that time, this unadorned and simple article was thought sufficient for every purpose where porcelain was not employed; and the neatness and cleanliness of its appearance gave it such a decided preference, that her late Majesty allowed the worthy inventor to call it *Queen's ware;* but, when a demand arose for more expensive services of pottery, recourse was had to the pencil. From that period, a great number of artists have been constantly employed in painting earthenware, as well as porcelain, and often great taste is displayed in these productions.

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* The beautiful black glaze, which is seen on a peculiar sort of ware made at Nottingham, is composed of 21 parts by weight of white lead, 5 of flints, and 3 of the oxide of manganese. Watson's *Chemical Essays*, vol. ii. page 271

It must not, however, be imagined, that painting on earthenware was a new invention. The paintings of the ancients, of this kind, are rare and valuable. The Marquis Marcello Venuti, in his description of the curiosities found in the ancient city of Heraclea, speaks of one upon *slate*, representing a muse crowned with laurel, with a musical instrument hanging on her shoulders, which was found in one of the subterraneous cavities, and is described as being then in the possession of Signor Nicolo Vagnucci, of Cortona, one of the principal supporters of the Academy of Tuscany.*

Nevertheless, it must not be concealed, that Chaptal has shown, that the Romans of the first century were not acquainted with any of the metallic fluxes with which the moderns fix and vitrify the coverings of their pottery. For the particulars, consult his very instructive account of certain colours which were found in the shop of a colour-merchant, in one of the streets of the ancient Pompeia, especially as he has there told us what was the composition of the glaze which the potters of that day did actually employ.†

To return to the consideration of the paintings on English earthenware, it must be observed that the variety of effect is produced by means of the different metallic oxides, each of which affords a different colour, and these colours are again multiplied by such mixtures of two or more of the oxidized metals, as experience has shown to be useful.

In employing these various colours, the ground oxide is first mixed with a prepared flux, which is also reduced to an impalpable powder, and then this mixture is well incorporated with gum water, the acid of tar, oil of turpentine, or some other essential oil, as may be most suitable, in point of expense or otherwise, for the goods on which it is to be employed. The fluids are used merely to lay on the colour; for it is necessary, that, whatever oil be employed, it should have the property of evaporating entirely.

The preparations which are commonly used, are the metallic oxides and their combinations with acids. Thus, cobalt yields a blue; antimony and silver, give yellows and oranges; platinum, a silver colour;‡ gold, violet and purple; copper, the greens; while the reds, the browns, and the blacks, are derived from iron.

The oxide of cobalt employed in the pottery, is usually prepared from zaffre, which is an expensive article imported from Saxony, though a few years ago, very fine oxide of cobalt was procured from Cornwall; for preparing antimonial yellows, the crude antimony is first calcined with four times its weight of nitre, and is then mixed with a certain proportion of vitrified lead. The precipitate of Cassius is the article which is generally used for the production of violets and purples, though sometimes the oxide of gold, precipitated by copper, is employed. For greens, the copper has usually been taken in the state of a precipitate; but some potters have found an article of more value in the pure oxide of copper, which they procure by placing sheets of copper in the ovens in which the ware is glazed; and it has lately been discovered, that a small portion of copper, mixed with the iron, very much increases the intensity of the blacks on earthenware. Besides, iron itself is capable of giving a great variety of colours, according to the way in which it is managed. For instance, the black oxide of this metal, produced by the action of heated air only, will be a very different article, when used as a pigment from an oxide of iron, prepared by other means.

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* Skurray's *Translation*, 8vo. London, 1750, page 107.

† *Annales de Chimie*, tome lxx. p. 22.

‡ Some observations by Klaproth, on the uses of platinum in pottery, may be seen in the *Phil. Mag.* vol. xvii. page 135.

It is here necessary to remark, that in painting on the biscuit, no oil is used; the metallic oxides are mixed with water only; and it is owing to this circumstance, that such ware may be glazed at once, without being put into an oven, as is the case with those goods which are known by the appellation of *blue-printed.*

For certain purposes, however, the painting is performed *upon* the glaze, as some colours would be injured, and others destroyed, by the heat of the gloss-oven. Thus, where iron is employed to produce blacks or browns, the painting is always done *upon* the glaze; the ware is then finished in an enamel-oven, at about 6° of Wedgwood's pyrometer.

Some metallic oxides are used for another intention, besides that of painting, viz. for the purpose of covering the ware entirely on the exterior, as is the case when the sulphuret of antimony is employed for producing a common kind of yellow ware; and also for those articles known by the names of GOLD and SILVER LUSTRE. The first of these lustres is effected by means of gold, the latter by the oxide of platinum. For gilding porcelain, the metal is used in its metallic state. To procure it in a pulverized form, it is dissolved in aqua regia, and then the acid is driven off by heat, and the gold remains: this is then mixed with borax and gum-water, which form together a proper vehicle for fixing it upon the goods. After this it is baked, and finished by burnishing.

For preparing the lustre ware, as it is called, the oxide, of whatever kind it may be, is mixed with some one of the essential oils, and in that state it is brushed upon the surface of the articles. It should have been observed, that when the manufacturer intends to make lustre-ware, the articles are glazed *before* the gold or the platinum is applied. For *gold*-lustre, the ware is made of a red clay, which, when burnt and glazed, shows so much of its colour through the covering of gold, as is sufficient to give the goods that peculiar brown tint, which is always observable on this singular kind of pottery.

When the metallic oxide has been properly applied to the surface of the goods, they are carried to an enamelling-oven, where the heat dissipates the oxygen, and restores these precious metals to their metallic state,—I cannot say quite to their primitive metallic brilliancy, because this is often much injured by the fluid menstruum employed in the operation. The great difference which there is in the appearance of this ware, especially in that which is covered with platinum, can only be thus accounted for. Some of it looks like silver, while the articles from other manufactories, are more like iron, or steel.

I once imagined that this variation might arise from a different mode of preparing the oxide of platinum. I therefore prepared two samples of this oxide, the one precipitated by caustic ammonia, and the other by muriate of ammonia; but, when I had them tried by an experienced potter, both produced precisely the same colour.

I wish some manufacturer would attempt to produce this ware by mixing the oxide of platinum with pure water only; for in that case, I am persuaded, the ware, when finished, would be as white as the platinum itself.

The potters, of England, have derived great advantage from the introduction of the printing-press. The use of this valuable machine, which is comparatively of late date, has enabled these manufacturers to produce a greater variety of patterns, and of neater execution, than could possibly be acquired, at a small expense, by the pencil.

As this is a curious branch of the business, it will be proper to describe it a little more particularly. It consists in first printing the intended pattern, with some metallic colour, chiefly the oxide of cobalt, on what is called *silver* paper, and then in transferring the colour from the paper to the surface of the porcelain. This style of colouring earthenware, is a very successful imitation of the old blue porcelain of China, and of late years, has been the means of extending the consumption of British pottery throughout Europe, more than any other improvement in the manufactory; for the potters of China are totally unacquainted with the printing-press, and consequently all their designs are produced by the pencil alone.

This mode of imparting designs to the surface of earthenware, or porcelain, and which is known in the trade by the appellation of BLUE PRINTING, is managed somewhat in the following manner.

One man constantly attends the press, which is very similar to our common copper-plate printing-press; and as soon as he has applied the colour, which is laid on the copper in the same manner as the copper-plate printers apply the ink, he lays it upon a hot iron, to thin the oil with which the colour is always mixed for this purpose. The oil which is used, is a peculiar preparation of boiled linseed oil. When the colour upon the copper-plate is thus reduced to a proper consistence, a sheet of silver paper is laid over it, and the workman passes it, with the paper, through the press.

For blue printing, the oxide of cobalt is the only mineral which is employed. This is largely prepared in the Staffordshire potteries, and sells from 40*s.* to 60*s.* the pound, according to its intensity and goodness. Indeed, such improvements have been made in the manufacture of this colour, that the Chinese potters are now supplied from England with all the cobalt they consume.

When the paper comes from the printing-press, it is, of course, found to be stamped with the intended pattern. It is then delivered, while wet with the colour, to a girl, who cuts off the superfluous paper with a pair of scissors, and passes it to another girl, who immediately applies it to a piece of biscuit ware, and then delivers it to a third, who fixes it more firmly by rubbing it very hard with a piece of flannel, tightly rolled up in the form of a short cylinder.

The design of this hard rubbing is to force the colour into the pores of the ware. When the papers, which have been thus applied, have lain on for about an hour, the colour is generally found to be sufficiently fixed to admit of their being detached. This is effected by putting the articles into a tub of water, where the paper soon becomes soft and pulpy enough, to allow of its being peeled off by gentle friction, leaving the full impression of the pattern upon the biscuit.

The papers having been removed, the ware is suffered to stand a sufficient time to become dry, and then it is put into an oven at a low heat, for the purpose of dissipating the oil, and preparing it for receiving the glaze.

It must be obvious that it is necessary to employ a glaze which is transparent, in order to give full effect to the brilliancy of the cobalt colour. A little of this blue oxide is also generally mixed with the glaze, for the same purpose as laundresses employ smalt, with their starch, viz. to increase the whiteness, by subduing any yellow tint, that might otherwise impair its lustre.

Here I cannot avoid observing, that it would be an important acquisition if some suitable article, instead of oil, could be discovered for mixing with the colours which are employed in printing on earthenware, and which could be of such a nature as not to require to be burnt off previously to the application of the glaze. It appears to me to be worth while to institute a series of experiments for this particular object; because, if it could be attained, what immense quantities of printed goods, besides those which are ornamented by the pencil, might be completely finished with two firings, instead of three, which, on the present plan, such goods always require! Were it on no other account than the expense of this vehicle, it is desirable to find a substitute. Some of the first enamel-painters think it necessary to use even the best rectified oil of amber, and this, of late years, has been very costly.

Another idea occurs to me respecting printed ware, which, however fanciful it may now appear, will, I doubt not, some time or other be realized. What I refer to is, the possibility of printing two or three different colours at once, like the Lancashire calico-printers. This, I presume, would be a discovery of great importance to every manufacturer of fine earthenware or porcelain.

A red oxide of iron, more brilliant than any hitherto employed, would be also a valuable acquisition. That which is commonly used, is procured from green vitriol by calcination; but I would suggest that a much finer colour might be prepared from *nitrate* of iron, and advise the potter to take several portions of it, and precipitate the iron by the different alkalies, each in a state of causticity; and by these means he would readily discover which produced the best, and the brightest, colour. If four distinct precipitates were made, viz. one with lime, another with potash, a third with soda, and a fourth with ammonia, it is probable they would be found to be of very different value, for the purpose of painting on china. The alkaline carbonates would probably give precipitates of inferior qualities; but by a subsequent calcination, the carbonic acid would be separated, and something valuable might be produced.

In making this experiment, it will be necessary to prove all these different oxides on exactly the same kind of porcelain, or the result might be deceptive; for it is well known to practical men, that the oxide of iron will not produce the same fine red upon *common* china, as it will upon the hard porcelain, which is glazed with felspar.

The residuum which is produced by those makers of aqua-fortis who use sulphate of iron, instead of sulphuric acid, might answer a good purpose, if thoroughly freed from the alkaline salt, which it always contains.

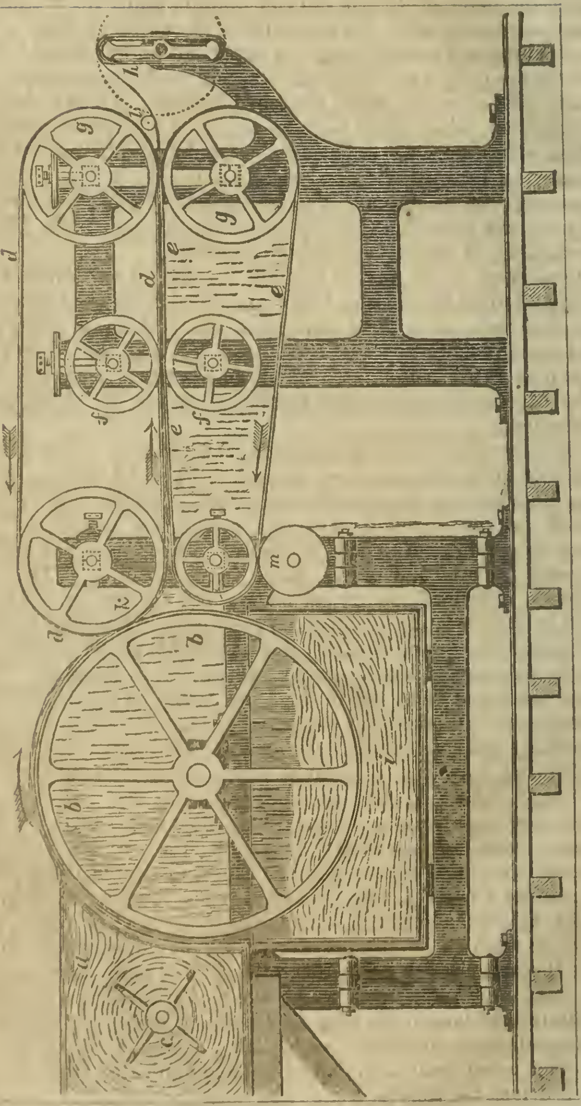
It was my intention to have offered some remarks on the manufacture of crucibles, retorts, and other chemical vessels, which are required to sustain a great heat; but having already extended this essay much beyond its proposed limits, I must content myself with merely referring to those authors, who have already treated on this subject. The most important of these is Pott, who wrote a work expressly upon it, as I have already mentioned.

I shall detain the reader, however, just to notice, that the chief difficulty which the manufacturer finds in preparing such utensils as crucibles, &c. is, that if the portion of silica were employed which is necessary to give sufficient compactness, the ware would, from this very circumstance, be liable to become useless; because many of our chemical articles have the property of dissolving silica. An expedient has therefore been adopted, of mixing a large portion of old pottery with the fresh clay, which gives it the desired weight, and yet is not liable to be dissolved by the alkalies, like pure flint, or sand.

I am moreover desirous of suggesting, whether it might not be adviseable to mix alumina and silica in certain proportions; and, having kneaded this mixture into balls, to burn them in an oven, at the highest temperature the mixture can endure; and whether such a preparation would not be more suitable for grinding with fresh clay, than the old pots, which have hitherto been used for this purpose. I imagine that vessels made in this way, would stand heat and cold better, because the pores of the old stuff are often so close, that it cannot expand and contract by alternations of temperature, as it ought to do. I mean, however, very soon to ascertain this, by some direct and decisive experiments.

I am informed, by a Sheffield manufacturer, that their cast-steel makers mix ground coke with the best Stourbridge clay, and that their crucibles for melting steel, are made with this mixture. Pure earthenware is not fit for crucibles, or for any vessels that must expand, or contract, by change of temperature. This has been long known; Dryden notices it in one of his poems.

ENGLISH PATENTS.



Dennison and Harris's *Patent Paper making machine.*

A description of DENNISON *and* HARRIS'S *Patent Paper-making machine.*

THE art of making paper, in one continuous sheet of any required length, our readers will recollect originated from an ingenious Frenchman of the name of Didot, who, in conjunction with Messrs. Fourdrinier, succeeded after the expenditure of enormous sums of money, in perfecting, and establishing, this important improvement. By their method, the pulp was delivered in a thin uniform stratum, upon an endless web of woven wire, stretched between and over two revolving cylinders, whose axes were on the same horizontal plane. This endless web of wire work, formed the mould, and became the vehicle for carrying forward the newly-made paper, to be operated upon by the subsequent processes. The mechanism of these machines, especially as now manufactured by that able engineer, Mr. Donkin, of Bermondsey, is highly curious and beautiful.

Subsequent to the period alluded to, several variations from the method adopted by Messrs. Didot and Fourdrinier, but nearly on the same principle, have been applied to the making of paper; among which, that invented by Mr. Dickenson, in 1809, should be mentioned, as it bears a considerable analogy to the newly-patented machinery, by Messrs. Dennison and Harris, of Leeds, which we have now to describe.

a is a vessel containing the pulp, considerably diluted, which is preserved at the desired level by any of the usual means, so that the pulpy liquid, when the machine is at work, shall flow over the curved side of the vessel into a revolving cylindrical mould, *b*. In the vessel, *a*, a vane, *c*, is made to revolve to keep up a powerful agitation, and prevent any of the fibres from subsiding. The rotatory mould, *b*, is formed, on its periphery, like a sieve, and, as it turns round in the direction of the arrow, the pulp is received upon it; the chief part of the water instantly drains through the bars of the mould, and the paper, in a loose, spongy, wet, state, is formed. The continued motion of the mould brings this pulpy matter in contact with an endless felt, *d*, which, by a superior attraction of cohesion, attaches to itself the pulpy fabric, and carries it forward between that felt, and another felt, *e*, where it receives pressure; first from a pair of *wet rollers*, *ff*, then a greater pressure from the *dry rollers*, *g g:* from thence the paper, in a comparatively dry state, is taken up by a rotatory vane, *h*, upon which it is folded; when this vane is fully charged it is removed, and another vane substituted in its place. In this manner a sheet of paper, of any required length, may be produced.

The cylindrical mould, *b*, revolves in a vessel of water, *i*, which serves to wash off the fibrous matter that may adhere to it, and to receive the water which drains from the diluted pulp, as it passes over. The cast-iron frame upon which the mould revolves, is jointed, to facilitate that lateral shaking, or trembling motion, essential in the making of paper, and which is effected by a crank and rod, or by any of the other usual means, motion being communicated from the gearing which drives the rollers, &c.

The roller, *k*, is called the *combing roller*, as it takes the paper off the mould. This roller is provided with a regulating screw to tighten the web,* or adjust the pressure against the mould. The upper *wet roller, f*, and the upper *dry roller*, *g*, have, also, regulating screws, by which they may be elevated or depressed in the long slots, wherein their axes revolve, so as to increase or diminish the pressure upon the wet paper. A small roller, *l*, is employed for assisting in separating the paper perfectly, as it passes from the felt on to the vane, *h*. As the lowermost web becomes very wet by receiving the water from the paper, a small cylinder, *m*, is employed to press out the water from it, as it revolves. For the perfect cleansing of the webs from the fibrous matter, small rotatory brushes are directed to be fixed so as to brush over their surfaces; and the employment of jets of water to wash over the felts, is also recommended by the patentees.

In the arrangement of the several parts of this machine, there is some degree of novelty, which the patentees claim as their invention; they also claim the peculiar construction of the rotatory mould. The external outline of this mould, presents, precisely, the figure of a common drum; its periphery is formed by connecting together a series of metallic rings; the cylinder is then covered longitudinally with numerous small thin bars of copper, $\frac{3}{8}$ of an inch wide, placed edgeways, so as to present a complete grating over the whole surface. The copper bars have numerous small lateral projections, to keep them at a regular distance apart: these are directed to be made by passing plain slips of copper between cylindrical steel rollers, with indentations on one of them adapted for producing a uniform series of little stubs. [*Register of the Arts.*

Heathorn's Patent combination of a Lime Kiln with coke ovens.

The object of this invention is to prepare quick-lime, and coke, in the same kiln, by a single operation; and the arrangements to effect it, are at once so simple, and so complete, as seemingly to preclude the capability of any material improvement. The economy of the process is likewise carried to the greatest possible degree; for that portion of the coal which is separated from it, in forming coke, is, by its combustion, rendered subservient to the burning of the lime stone; and the coke, owing to its increased bulk, being nearly (if not quite) as valuable as coal, in the market, the expense, if any, must be very trifling.

The following engraving represents a vertical section of the lime shaft and coke ovens: *a a* are the side walls, four feet thick, in the form of a rectangular tower, the internal space being filled with lime stone, from the top, to the iron bars, *b b*, at bottom, whereon the whole column rests. The lime stone is raised in a box *d*, or other proper receptacle, to the top of the building, by means of a jib and crane *e*, or other tackle, which is fixed at the back of the tower, together with a platform, projecting beyond the walls for affording security, and convenience for "landing" the lime stone: when raised as represented, the jib is swung round, and the lime box tilted, by which the whole contents are thrown down the shaft.

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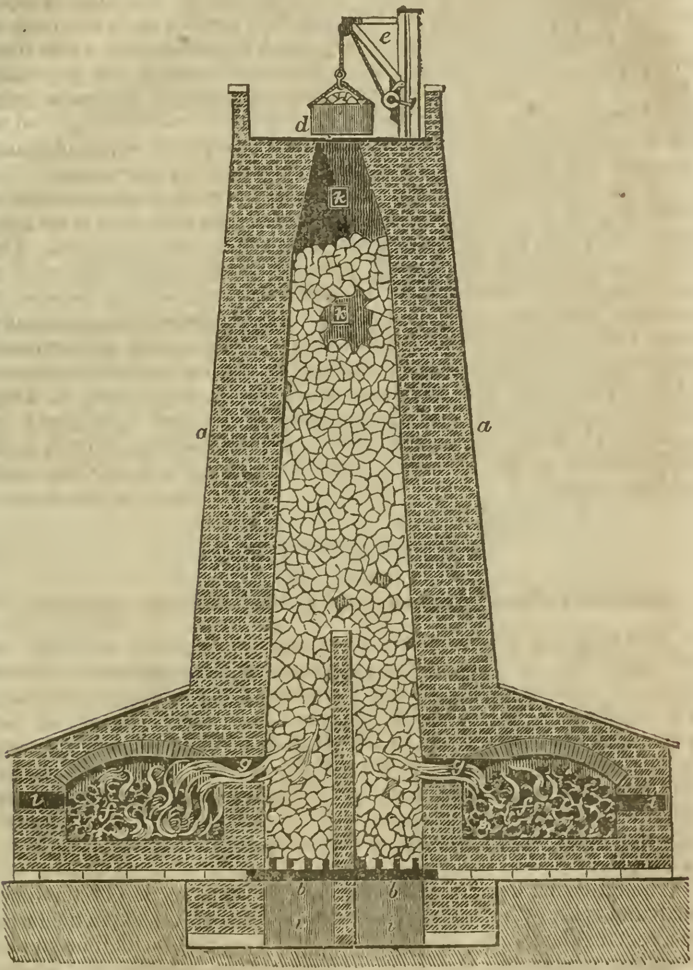
* For this purpose the screw appears to be put upon the wrong pulley.



The coke ovens, of which there may be two, or a greater or lesser number, according to the magnitude of the works, are constructed and arranged, in connexion with the lime shaft, in the same manner as the two represented in the diagram at *f f*. These ovens are supplied with coal through iron doors in the front wall, (not seen in the section;) the doors have a long and narrow horizontal opening in the upper part of them, to admit sufficient atmospheric air to cause the combustion of the bituminous or inflammable part of the coal; the flames, proceeding from thence, pass into the lime shaft, through a series of lateral flues, (two of which are brought into view at *g g*;) and the draft is prevented from deranging the process in the opposite oven, by the interposition of the partition wall, *h*, which directs the course of the heat and flames, throughout the whole mass of the lime; the lowermost and principal portion of which, attains a white heat, the upper a red heat, and the intervening portions, the intermediate gradations of temperature.

When the kiln is completely charged with lime, the openings in front and beneath the iron bars, at *i i*, are closed and barricaded by bricks, and an iron-cased door which is internally filled with sand, to effectually exclude the air, and prevent the loss of heat by radiation. Therefore, when the kiln is at work, no atmospheric air is admitted but through the narrow apertures before-mentioned in the coke oven doors.

When the calcination of the lime is completed, the barricades at *i i* are removed, the iron bars at *b b* are drawn out, by which the lime falls down and is taken out by barrows. It sometimes happens, however, that the lime does not readily fall, having caked or arched itself over the area which incloses it, in which case a hooked iron rod is employed to bring it down. To facilitate this operation in every part of the shaft, where it may be necessary, a series of five or six apertures, closed by iron doors, are made at convenient distances from the top to near the bottom of the shaft; two of these are brought into view at *k k*, where their utility is made apparent in the diagram. Two similar apertures are shown in section in the coke ovens at *l l*, which are for the convenience of stoking, or clearing out, the lateral flues, *g g*, from any matter that might obstruct the free passage of the flames and heated air.

When the coals have been reduced to coke, the oven doors in front (not shown) are opened, and the coke taken out by a peel iron, the long handle of which is supported upon a swinging jib, that acts as a moveable fulcrum to the lever or handle of the peel, and thus much facilitates the labour of taking out the contents of the oven.

The other arrangements of the patentee for conducting the business of lime and coke works, economically, on the large scale, are worthy of the particular notice of persons engaged in that department of our manufactures; but our limits prevent us from going into their detail. There are, however, some points of importance, as respects the latter class of persons, which we ought not to omit, and as these are stated in a letter received from the patentee (which brought the subject under our notice, and induced us to examine the enrolled specification) we here subjoin it.

Maidstone, 4th Dec. 1826.

Sir,—I beg to introduce to your notice a sketch of a lime-kiln, wherein the whole of the fuel employed, is saved, by its being converted into coke.

After a number of experiments on various kilns constructed on different plans, and conducted under my own immediate inspection, for upwards of ten years past, this kiln has been completed; and (with the advantage of saving the whole of the fuel,) possesses a facility of drawing the lime, equal to a common tunnel-kiln. The gradual manner, also, in which it causes the chalk or stone to be burnt into lime, is such as to leave no refuse whatever, and consequently, the usual operation of sifting the lime is unnecessary.

This kiln is now, and has been for some time past, in full operation, and may be inspected at the Lime Works of the patentee, Mr. Charles Heathorn, Maidstone.

I am, sir, very respectfully, yours,
Charles Heathorn.
[*Register of Arts.*

Description of Dunn's Patent Screw Press.

This is a convenient modification of the Screw Press, for the pressing of paper, books, tobacco, cloth, &c. and for expressing of oil, extracts, tinctures, &c.

Instead of the simple lever, consisting of a long straight bar, which requires so large a space to move it in, the patentee uses a compound lever, (much like those employed in the ordinary printing press,) by which means the same power is obtained in a much more compact apparatus.

Fig.2.

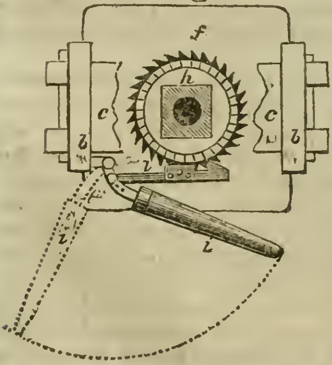


Fig.1

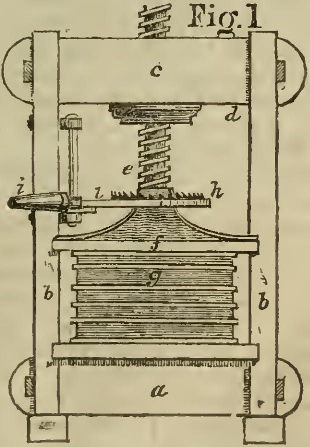


Fig. 1 represents an elevation of the complete press, and Fig. 2 a plan of the improved part of the machine; the like letters in each figure denoting similar parts.

a is the bed of the press, of massive oak; *b b* the cheeks, or side framing; *c* the head; *d* the nut, fixed into the head, through which the screw, *e*, is turned; *f* is the platten; *g* the goods, together with the press boards, or metal plates between them. Thus far the press is like others; but instead of having a large screw-head, with apertures for the insertion of a long lever bar, that part of the screw is squared, and on it is fixed a circular metallic plate, or wheel, *h*, with a double row of ratchet teeth; one of the rows of teeth project horizontally from the periphery, the other vertically; as will be understood, upon examining both figures. *i* is the handle of the compound lever, which being formed into a circular eye at the farthest extremity, is thereby fixed upon, and traverses up and down the fulcrum, *k*, which is an upright bar, firmly bolted to one of the cheeks of the press. To alter the power according to circumstances, the curved end of the handle, *i*, is perforated with several holes, to receive a key, or bolt, which fastens the other portion, *l*, of the compound lever to it, (best seen in Fig. 2;) the extremity of *l* is hooked or notched, so as to take hold of the teeth of the ratchet wheel, and it has a plate screwed on to it at *o*, to prevent it from falling off. To support the compound lever at the required elevation, a stout pin is passed into a hole, of which there is a series made for the purpose, in the side cheek.

In operating with this press, the goods are laid upon the bottom board in the usual manner, the platten *f* is then brought down by turning the ratchet wheel round by hand. The pressure is then given by pulling back the handle *i* in the direction, and to the position, shown by dotted lines in Fig. 2; by repeatedly moving the handle in this way, the ratchet wheel is drawn round by the lever, which causes the screw to descend, and to force the platten against the goods; during this operation, it will occasionally be necessary to let the lever descend upon the fulcrum, by taking out the supporting pin, and putting it into the next hole beneath.

When it is required to unscrew the press, the hooked end of the lever *l* is placed in contact with the circle of teeth on the upper surface of the ratchet wheel; the lever being then pulled the reverse way, the screw is raised, and the pressure taken off.

[*Ib.*

Williams and Doyle's patent apparatus for separating Salt from Sea Water, and rendering it fresh.

The patentees of this invention are Mr. John Williams, ironmonger, and Mr. John Doyle, merchant, both of the Commercial Road, Middlesex; and if the statements contained in their specification be true, it is really one of very great importance. To separate the salt from sea-water, by simple percolation through a body of sand under mechanical compression, and thereby render it fresh, appears to us so extraordinary, that we should be somewhat sceptical of the fact,* were we not persuaded that the patentees must have repeatedly proved it to be the case, before incurring the expense of a patent-right. We have had no communication with either of the patentees on the subject, (having merely read the specification at the patent office, where it has just been enrolled;) but should either of those gentlemen favour us with the details of their experiments with the apparatus, we are sure they would be read with much gratification, and, probably, be conducive to their advantage, from the great circulation of our work among the shipping interest.

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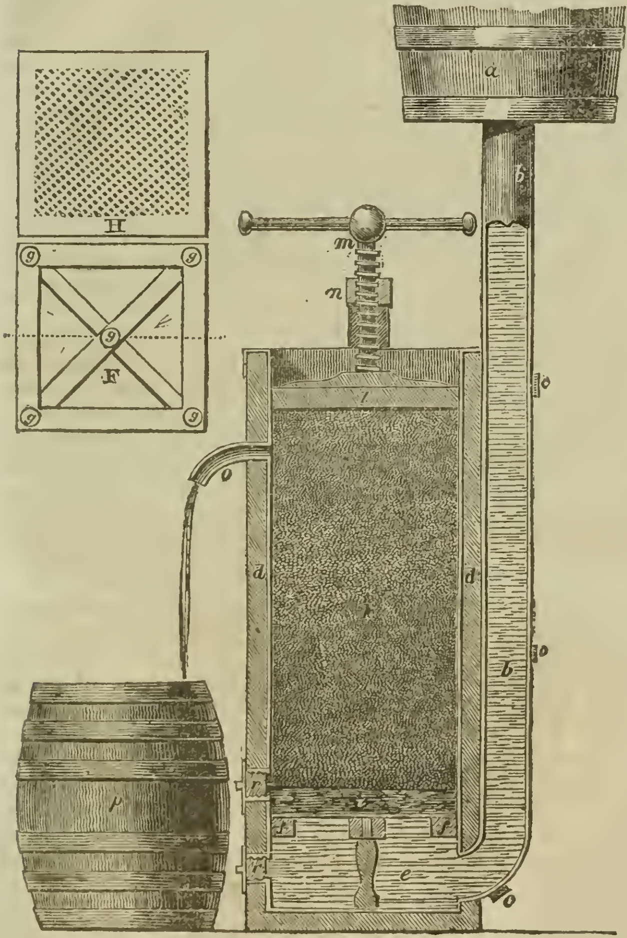
* May not some of the fresh water springs which are found near the shores of the sea, derive their source from the ocean, the salt being deposited as the waters rise through the superincumbent earth?



The preceding engraving, though it does not embrace all the drawings attached to the specification, sufficiently illustrates the process, and one of the modifications of its construction.

a is part of a cask, supposed to contain sea water; *b* a tube descending therefrom, made fast by bands, *c c c*, to the filtering apparatus, *d d*, which is a strong square trunk of wood, lined internally with sheet lead, which is cemented to it, that the water may find no passage between: this part of the apparatus is given in section, that the construction and arrangement may be seen in one view. *e* lower chamber, where the water is first received; *f* a strong stool of open frame work, supported upon five stout legs *g*. (A plan of this stool is given in a separate figure F, the situation of each of the five legs being marked with a *g*.) Over this stool frame is nailed a plate of copper, pierced with numerous small holes: this plate of copper is also shown by a separate figure H. Over the perforated copper plate are several layers of woollen cloth, or woven horse hair, *i*, and above these, a body of sand *k*, filling up the entire trunk: on the top is placed a sliding cover *l*, which is operated upon by a strong screw *m*, working through a fixed nut *n*, which is supported by curved iron arms extending from the opposite sides of the trunk.

The sand having been compressed by the agency of the screw, into a more dense and compact mass, is prevented from rising by the pressure of the water, which, percolating through the minute interstices to regain its level, deposits its salt, and runs out of the pipe *o* in a fresh state, into a vessel *p* placed to receive it.

When the sand has become saturated with salt, it is to be removed by taking out the screw and the pressing board *l*. The main holes *r r* may then be opened, by unscrewing the plugs, when the other materials may be easily shifted. These matters being completed, a fresh quantity of sand may be taken from the ballast of the ship, and the process of filtration be repeated as before. The sand that has been saturated with salt in this manner, serves still *as ballast*, and, on the arrival of the ship in port, and the discharge of her ballast, it is considered that *the salinous sand will form an excellent compost for manuring land.* [*Ib.*

Remarks by the Editor.—A simple and easy process for separating the salt from sea water, so as to render the water fit for ordinary use, is 'a consummation devoutly to be wished;' but we must unlearn all our chemistry, and admit that 'chaos has come again,' before we believe that Messrs. Williams and Doyle have *sifted* the water from the salt. If they have 'repeatedly proved it,' they must have proceeded in a manner similar to a wiseacre of our own country, who obtained a patent for the same thing, after having proved it, once at least; but he at length discovered, that the fresh water which he obtained, was that portion which he had poured in to moisten his sand, before attempting to filter his salt water, and which the latter forced out.

James's Patented improvements in Rail-ways and Locomotive Carriages.

It has, we believe, been a generally received opinion, that carriages on a rail-way cannot be propelled by locomotive power up an inclined plane that rises more than twenty feet in a mile, without the assistance of indented or toothed rails to increase the resistance, and thus prevent the carriages from slipping back. By Mr. James's new improvements, this difficulty is, however, so completely overcome, that a train of carriages may now be made by a locomotive engine to ascend and descend inclined planes of any elevation necessary in the construction of rail roads, and over very smooth and almost polished surfaces. We understand that the most satisfactory proofs have been afforded of the ability to effect this, by repeated trials on a rail road more than a hundred feet in length, laid down for the purpose of experiment; on which it was found that a train of carriages would (with the patentee's improved machinery) ascend inclined planes of 3 inches in the yard, which is equal to 440 feet in the mile. This important advantage is gained by applying the power to the axletrees of the wheels of the several carriages in the train, by means of the rotation of a long horizontal rod (or series of connected rods) actuated by bevel gears under each carriage.

The other improvements are for enabling the carriages on a railway to pass around turns or curves in the road without additional friction. For this purpose, the horizontal rotatory shafts, which cause each pair of wheels in the train to revolve and propel the carriages forward, are connected together by a novel and very ingenious kind of universal joint, which communicates the rotatory motion to each successive carriage, even if so placed on the curves of the roads that the sides of one carriage shall present to the side of the next an angle of 30 degrees. To cause the carriage wheels to run round the curves of the rail-way without the usual destructive rubbing of their surfaces, the rails in those parts are made with several ribs or elevations, and the wheels of the carriages are consequently formed to correspond with those ribs, by their peripheries being grooved in like manner; so that a wheel, in effect, possesses as many diameters as there are variations in the surface of its periphery, by which means, it may be made to travel faster or slower, as may be desired.

That these consequences result from Mr. James's improvements, will be readily seen on reference to the engravings, which we shall here introduce.

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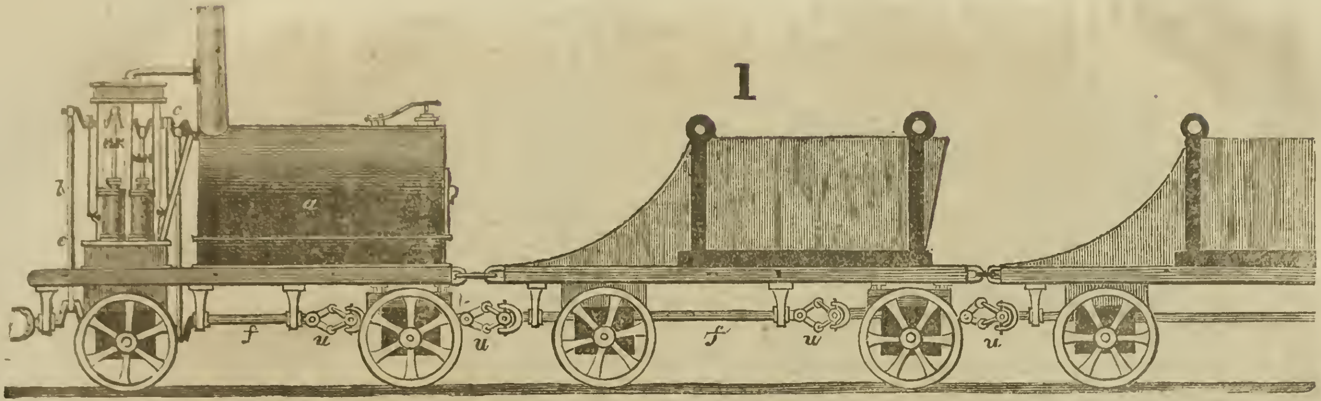
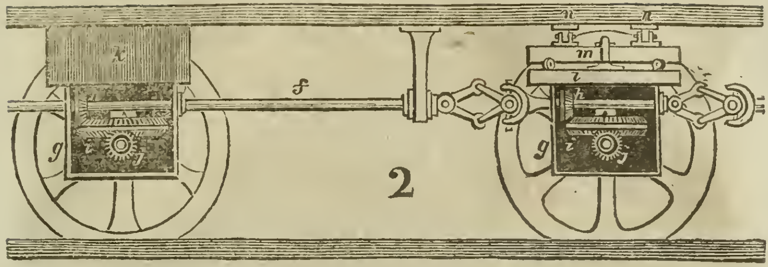


a is the boiler of a steam engine, *b* the engine with two cylinders, the alternating motion of the piston in which, gives rotation to the crank *c* above; the rods *e e*, attached to the same, being also fixed to the crank of the horizontal shaft *f f f* (which passes under the carriages,) cause that to revolve with a similar speed to the crank of the engine. Two square boxes, *g g*, are fixed under each carriage; through these, the axletrees of each pair of wheels, pass; the rotatory shaft *f* passes also through the boxes above the axletrees, and at right angles with them; each of the boxes, *g g*, contains a double bevelled horizontal wheel, which presents a circle of cogs in its upper as well as its lower side, and turns upon cross bearings; now the shaft *f*, carrying upon it a vertical bevelled pinion in each box, takes into the upper circle of teeth of the horizontal wheel, while the under circle of teeth of the same, actuate a bevelled pinion on the axletree underneath; consequently, compels the wheels to revolve; and the power being thus applied to every pair of wheels simultaneously, sufficient resistance is obtained, on a smooth surface, to ascend inclined planes of considerable elevation. *u u u u u* are the universal joints, which communicate rotatory motion, when the carriages are not in a straight line: these, and other moving parts, are distinctly shown in the annexed figure, which is upon a larger scale.



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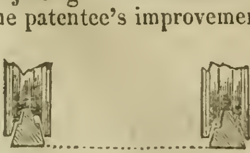
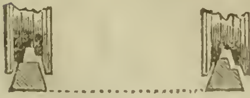
f f is the rotatory shaft; *g g* the two boxes, with the front plates removed to show the gear inside; *h h* the bevelled pinions upon the shaft in each box; *i i* the horizontal double bevelled wheels. The front box, *g*, under the carriage, is fixed immoveably to a solid block of wood; the other box is fixed to a plate *l*, turning on a central point, which passes through another plate, *m*, above; the plate, *m*, being secured to the floor of the carriage by hinge joints, *n n*. The construction of the universal joints, *u u*, are also more clearly shown in this figure.

We have now to describe the highly ingenious contrivances by which the patentee obviates the destructive effects of the rubbing or sliding of the inner wheels of carriages in making curves or turns in a road; contrivances that, at first sight, may appear simple and unimportant, but which, in our opinion, evince a considerable degree of skill in the inventor.

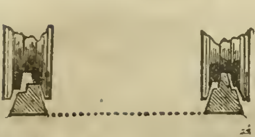
Our readers need not be informed, that if the wheels on one side of a carriage be larger, or of greater diameter, than those on the opposite side, such carriage, when propelled, will necessarily make a curve. On this principle the patentee's contrivances are founded. In running along a straight line the peripheries of the wheels are of equal diameter, and the bearing upon the rails are of equal elevation; but when the carriage has to make a turn, the wheels on one side roll upon a greater diameter, or more extended periphery; while the wheels on the opposite side run on a less extended periphery, and the elevations upon the rails upon which they run are so adjusted to these variations, that the different peripheries of the wheels change, and come in contact with the variable parts of the rail, and run round the curves, without any perceptible increase of friction, or jarring, or jolting. The annexed diagrams are in illustration of this part of the patentee's improvements.



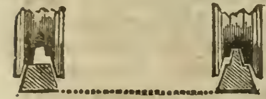
In this figure, the carriage wheels are supposed to be running in a straight line, consequently the peripheries are equal, and the bearings of the rail equal.



In this figure, the wheels are supposed to be making a curve equal to an increase of half an inch in a yard on the outer line or track.



In this, the wheels and other parts are adapted to make a turn, where the curve makes a difference in the two lines of two-thirds of an inch in the yard.



In this, a curve wherein the difference is one inch.

It is calculated that the following advantages will result from these improvements, viz.

A saving will be effected in the principal part of the cuttings, embankments, viaducts, &c. and a saving of full four-fifths of the time requisite for making the road. A saving in the land lost in deep cutting, and forming the slopes of the embankments; and in shortening the distance, in consequence of the engine and loaded carriages being able to pass over elevated ground; and owing to the resistance at each individual carriage, the engine carriage may be reduced full one-third in weight, therefore a greater load may be propelled by the same power. There will be a saving in the primary and current expenses of fixed engines, wherein the power applied is always the same, whether the traffic upon the road requires it or not, and in avoiding the delay consequent upon their employment; whereas, in locomotive engines the power may always be adapted to the trade, or load. An opportunity will be afforded of passing over, or under, turnpike roads, &c. by which much of the objection raised against rail-ways in populous districts is obviated; and the obstacles presented by private property may generally be avoided. In enabling the engine and train of carriages to be suddenly stopped, whether on level ground, or in descending hills, and also in reducing the liability to breakage, or accident, in stopping such carriages, in consequence of the number of parts to resist a sudden impulse, much will be saved.

Rail-roads of the usual construction soon get out of order by wearing at the turns, and in the settling of the ground in new embankments, which will be wholly prevented by the present improvements. There being no deep cuttings and embankments, property in land will not be divided by them, as in ordinary cases. By means of the joints (before mentioned) under each of the carriages, a nearly equal bearing of each wheel is effected, if the surface of the rails should be uneven; so as to cause the axles to stand at different angles. A considerable saving, it is considered, will likewise be made in the tonnage and interest of the capital expended, and in completing the rail in much less time than usual; also in the facility, and little expense, attending the making alterations in the rail after completion.

[*Ib.*

Account of W. H. James's Patent Steam Carriage.

Instead of actuating the several wheels of a carriage with a single engine, as heretofore, Mr. James adapts separate engines to each wheel. These engines are of small and equal dimensions, and have their steam supplied by pipes connected with the boiler, situated in a convenient part of the carriage. The object of the patentee, in employing separate engines, is, that each wheel may have a motion independent of any of the other wheels, so that their powers or velocities may be varied at pleasure, which is essential in passing round curves, or turning corners of the road; because, (as is well understood) when a carriage moves in the arc of a circle, the outer wheel passes over a greater distance of ground than the inner wheel —consequently rendering it necessary that the engine connected with the outer wheel, should be made to work so much faster than the engine connected with the inner wheel: this Mr. James effects most completely by a very charming and exceedingly simple contrivance, —he causes the fore axletree to be connected with a stop-cock placed in the main pipe, through which the steam passes from the boiler to the respective engines; this stop-cock is so constructed, that when the fore axletree stands at right angles to the perch, (i. e. when the carriage is proceeding in a straight line) it admits *equal quantities* of steam to each engine; but whenever the axletree stands obliquely to the perch, (as in making curves in the road) it causes the stop-cock to admit *a greater quantity* of steam to the engine connected with the outer wheel, so as to cause that wheel to revolve faster, and *a diminished quantity* to the engine connected with the inner wheel, so as to make it revolve slower, *in exact proportion* to the curve around which the carriage is moving.

Upon roads of moderate elevation, Mr. James applies separate engines to each of the hind-wheels only; but upon roads that have greater ascents, he employs four engines, that is, one to each wheel, and thus he obtains a greater degree of resistance or friction upon the surface passed over. In ordinary roads, however, Mr. James considers that two engines will be amply sufficient, because it is not required, *on this principle*, that the wheels shall be thrown out of gear, and in passing round curves they may be kept contantly in action; thus the amount of friction against the road will be preserved tolerably uniform, which is, of course, very important in propelling a carriage in the precise line required: if, under any circumstance, as in passing down hills, it may be advisable to lock one of the hind-wheels, it may be effected, as in other carriages, by putting on a drag.

From what we have already said, we think the advantages resulting from the employment of a separate engine to each wheel, must be apparent. The next desideratum was, to give each wheel an independent rotatory motion, without the necessity of employing *fly-wheels;* this Mr. James effects by having two small cylinders to each engine (as shown in fig. 1, which we shall presently describe.) Without such an arrangement, in passing over rough or loose ground, or in the ascending of steep hills, the impulse given to the carriage would not be sufficient to carry the engines over their centres.

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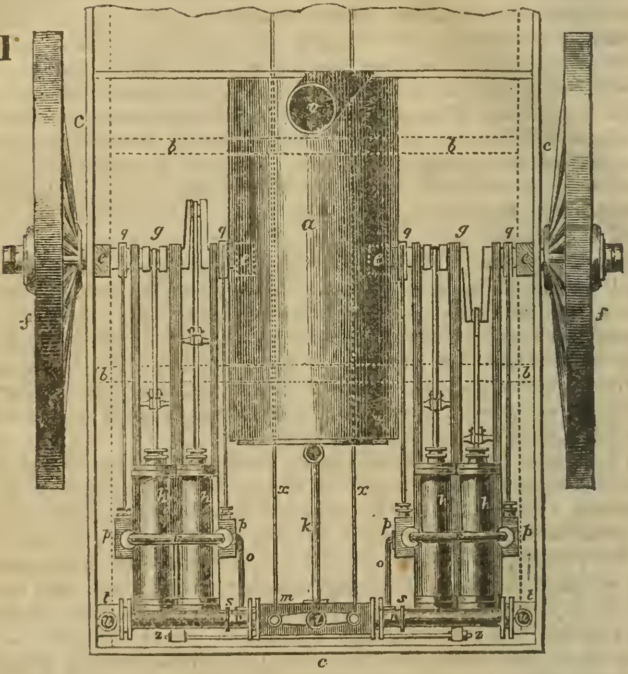

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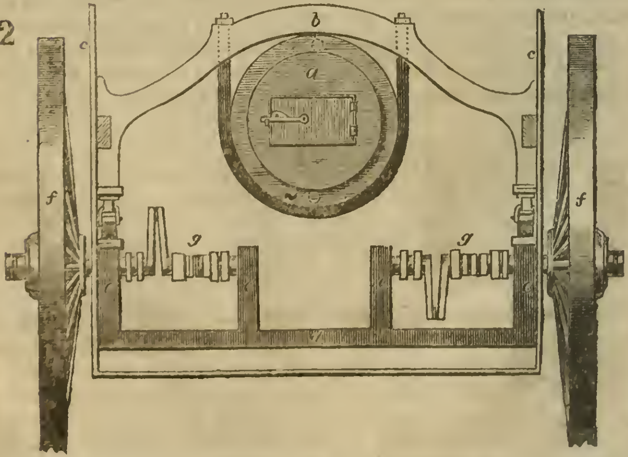

The next object, which has hitherto been considered as one of almost insurmountable difficulty—that of putting the whole of the machinery upon springs, so as to prevent any injurious effect to the acting parts from concussions, and likewise at the same time to allow of the perfect and uniform operation of the engines upon the running wheels, when passing over rugged surfaces,—Mr. James has completely effected, by causing the engines, and their frame-work, to vibrate altogether upon the crank-shafts, as a centre; at the same time connecting these engines *to the boiler and exit passages*, by means of hollow axles moving in stuffing boxes, which, together with the body of the carriage, is suspended upon the springs; these springs rest upon the axletrees, as will be understood by an attentive examination of the figures, (especially fig. 3) which we shall now proceed to explain.

Fig. 1 is a plan of the machinery of a carriage as applied to the hind wheels. Fig. 2 is a cross section, giving an end view of the boiler and the cranks, showing the manner in which the former is suspended, and its mode of attachment to the body of the carriage, and the situation of the springs on which it rests. Fig. 3 is a longitudinal section, giving a side view of the machinery as attached to the running wheels; similar letters of reference apply to the corresponding parts in each of the figures.

Fig. 1, *a a* represents the boiler suspended to the frame-work *b b b b* above, which frame-work is firmly attached to the body of the carriage, *c c c c*, and form its support; *d d* is the axle-tree, the form of which is best seen in fig. 2, has four supports, *e e e e;* the axles of the running wheels, *f f*, are fixed thereto, and are connected in one piece, with each of the crank shafts, *g g;* by which each of the wheels are made to revolve independently of each other. Each of the engines has two cylinders, *h h*, which operate by their piston rods upon the cranks: to these separate engines, steam is supplied from the boiler, *a a*, by means of the pipe *k*, which enters at the stopcock, *l*, into the steam box, *m;* from this box, the steam passes into the pipes, *n n*, which move steam-tight through stuffing boxes; from thence, the steam proceeds through the pipes, *o o o*, to the slide boxes, *p p p p*, the slides being worked by eccentrics, *q q q q*, on the crank

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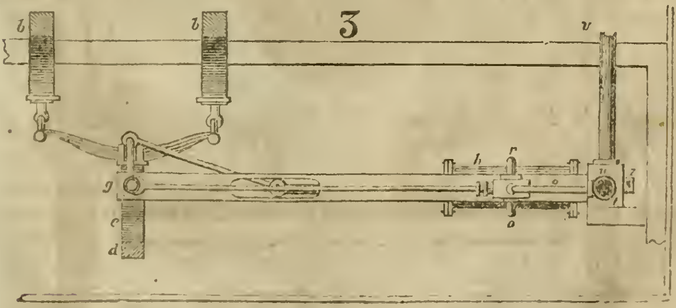


shafts in the usual manner, and from thence to the cylinders. The exhaustion pipes, *r r*, lead into the hollow axles, *n n*, before described, in which there are partitions, *s s*, to separate the steam from the exit passages, which pass through the said hollow axles to the boxes, *t t*, from which there are pipes, *u u*, leading into the chimney, *v*, shown in section. The rods, *x x*, are attached to the fore axle of the running wheels, and also to the two handles of the cock, *l*, so that the fore axle and the cock move simultaneously and parallel to each other. *z z* represents part of the frame work extended for tying the engines together by means of a connecting bolt; and so as to allow the body of the carriage to have a slight lateral motion upon its springs, independent of the engines, by means of the hollow axles sliding longitudinally through the stuffing-boxes.

In the preceding account we have given the substance of Mr. James's specification; and although it contains much novel and valuable matter, he limits his claim of patent right to the following points only, which we add verbatim:—

"I have herein described, for the perfect understanding of my invention, the general construction and operation of a steam carriage to be actuated upon my improved principles; but I do not mean to confine myself to this particular construction or adaptation of parts, *as my invention consists simply and exclusively in adapting distinct steam engines to the several wheels upon which the carriage runs, for the purpose of actuating such several wheels independent of each other, whatever may be the number of wheels so employed, or whatever may be the construction or position of the steam engines and their appendages so adapted, or whatever may be the form of the carriage to be propelled.*"

ENGLISH PATENTS FOR DISTILLING.

Among the subjects which have, of late years, received particular attention in England, that of improvements in the apparatus for distilling, holds a conspicuous place. We have obtained cuts of several of these, a part of which we insert in the present number, and shall give the remainder in our next. Our readers will not wish the whole detail of the patents; we shall present them, therefore, with the description of the engravings, with such other matter, only, as may aid in forming a correct estimate of the various plans; these descriptions are from the Register of the Arts.

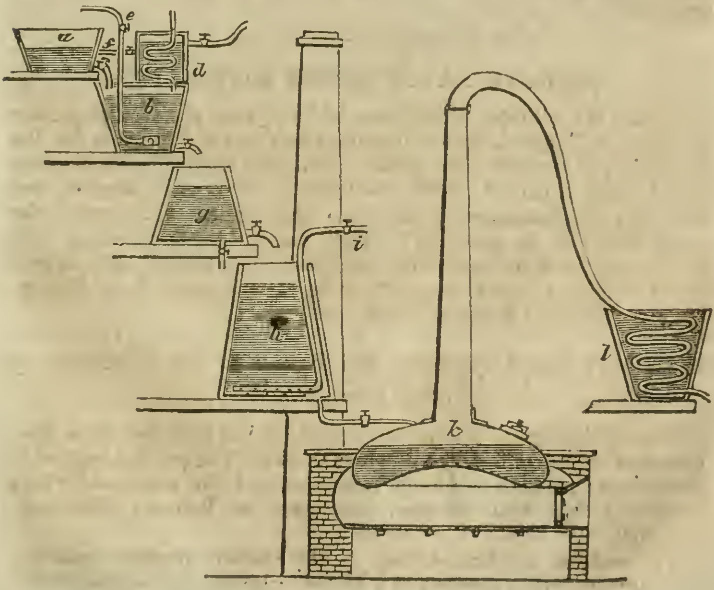
Saintmarc's Patent Apparatus and Process for the Distillation of Brandy from Potatoes.

The distillation of alcohol from potatoes has been for some time practised on the continent, with great success. The present apparatus and process are both of foreign invention, and the patentee for this country is Mr. Jean Jacques Saintmarc, of Belmont Distillery, Vauxhall.

The potatoes are first washed in the common machine used for that purpose, which consists of a hollow cylinder, the periphery of it being formed by open rails placed a little distance apart from each other; the cylinder is immersed in a vessel of water, and a rotatory motion being given to it, the dirt is quickly removed.

When the potatoes have been thus thoroughly cleansed from the earth which adheres to them, they are taken to the mill and ground into pulp; the pulp is first mixed with a large quantity of water, which takes up the chief part of the contaminating brown colouring matter, and it is then poured through a coarse sieve, which, detaining those pieces of potatoes that have escaped the mill without being ground into pulp, they are rejected as ineligible for fermentation, and applied to the feeding of pigs. The pulpy liquid, thus freed from the coarser pieces, runs into a trough containing a number of small holes, and lined, in the inside, with a linen cloth, sufficiently fine to prevent the floating particles of starch from passing through; the water then drains through the linen, leaving the pulp and starch to settle in a mass. When it has sufficiently drained, and become solid and compact, it is removed from thence and laid upon a plastered floor, which rapidly absorbs a great portion of its moisture. To dry it entirely, it is afterwards placed in a kiln or stove, which completes that part of the process. In the dry state, the pulp may be kept uninjured for years, and may, therefore, be stored away for future use. The wet pulp being, however, equally serviceable for immediate fermentation, there is no occasion to dry it, if the several processes in distillation, can be carried forward at the time.

Supposing the pulp to be used in the dry state, it is cut or broken to pieces, and mixed in the vat, *a*, with sufficient hot water to bring it to the consistence of cream. The vessel, *b*, lined with lead, called



the *decomposing vessel*, is then to be supplied with water about six inches in depth; to this a quantity of sulphuric acid is to be added in the proportion of three pounds of acid, to every hundred pounds of *dry* pulp, but only two pounds of the acid to every hundred pounds of the *wet* pulp.

The diluted pulp in the vessel *a* is then to be discharged, through the cock, into *b*, containing the diluted acid; further quantities of pulp and acid may in like manner be prepared until the decomposing vessel is sufficiently filled. Steam is then to be admitted from a boiler (not shown in the engraving) by turning the cock in the pipe *e*, which descends to the bottom of the vessel, where it is made to issue from a steam box; the heat causes the mixture to boil, and after four or five hours ebullition, the decomposition is considered complete. Before, however, describing the next part of the process, we should notice that a worm-tub *d*, supplied with water from the service pipe, is placed on the top of the decomposing vessel; the vapours from the boiling liquor beneath, enter this worm, and are therein condensed by transmitting their caloric to the surrounding water; and the water thus made hot, serves for replenishing the vat *a* with fresh portions, from time to time as it may be required, by means of a connecting tube *f* furnished with a stop-cock.

The contents of vessel *b*, after decomposition, are discharged into the *saturating vessel*, *g*, and during the time that is running, a quantity of lime or chalk, in solution, may be poured amongst it, as long as any effervescence continues, which will vary according to the degree of concentration of the acid; but in general three pounds of chalk or lime will be found sufficient to saturate each pound of sulphuric acid employed in the preceding part of the process.

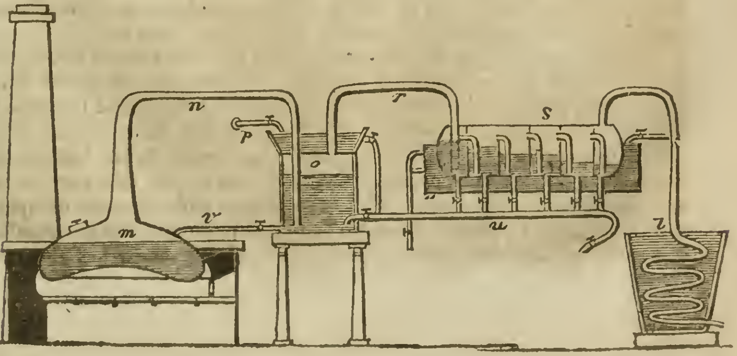
The liquid in the saturating vessel having now become transparent, it is to be drawn off into the *fermenting vat*, *h*, placed beneath, leaving the precipitated sediment undisturbed at the bottom whilst the clear liquor is running. The discharge cock being closed, the sediment may be stirred up with a quantity of water, to take up whatever saccharine, or fermentable matter it may contain; this should be allowed to settle again, and then added to the former liquor in the vat beneath.

To promote the fermentation, a quantity of yest is now to be added to the liquid, in the proportion of three pounds to every hundred pounds of potato pulp. During the fermentation, which usually occupies from fifteen to twenty days, the temperature of the liquid should be preserved at from 90 to 100° Fahrenheit, and the atmosphere of the room where it is conducted, at from 80 to 85°.

The patentee having discovered that the introduction of hydrogen gas facilitates the fermentative process, besides increasing and improving the product, further directs that the vat should be furnished with the tube *i*, along which the gas is to be forced, by means of a pump, into the liquid. The tube, after descending to the bottom of the vessel, takes a horizontal, serpentine course; in this part it is perforated with numerous small holes, through which the gas escapes and bubbles up through the liquid. This injection of the gas should be continued until the carbonic acid gas in the upper part of the vat contains an excess of the hydrogen. The patentee is of opinion that the introduction of hydrogen gas may be very advantageously used, not only in this process, but in the fermentation of all matters from which spirit, or alcohol, is to be extracted.

When the vinous fermentation has ceased, the liquor is to be drawn off through the tube into the still *k*, which is shown in section, built over the furnace. This still is of the ordinary construction, except that instead of having a large head or capital, it has a long neck rising perpendicularly from the body, the object of which is, that the aqueous part of the vapours may be condensed before entering the inclined part, and fall back into the still; while the more volatile, or spirituous, pass on alone into the bent arm, and from thence into the refrigeratory, or worm-tub, *l*, where it is converted into the ordinary first product of distillation, called *low-wines* (which is a very weak spirit.) The low-wines are then taken to another apparatus, which the patentee calls his *low-wine still*, to undergo a fresh distillation.

The *low-wine still*, and its several parts, are very judiciously adapted for conducting the subsequent process with great despatch and convenience. *m* is the body of the still fixed in brick-work over a furnace; a long perpendicular neck proceeds from this as in the former instance, the object of which is, that the aqueous part of the vapour may be condensed as it ascends and fall back again, while the more volatile and spirituous, passes on through the tube *n*, to the bottom of the vessel *o*. This last mentioned vessel has a tub of cold water placed on the top of it, which is kept supplied by the service pipe *p;* and as tube *n* passes through this tub, the greater part of the vapour in the tube *at first* condenses, and is received into the vessel *o*, in a liquid form; but as the vapour is continually coming over from the still, the condensed liquid is at length made to boil: the vapour filling the upper part of the vessel, from thence passes up the tube *r*, into the long cylindrical vessel *s*, which is partly immersed in a large cistern constantly supplied with cold water by the usual means. The cylindrical vessel *s*, is divided by five vertical partitions into six compartments, but having a communication from one to the other, by means of bent tubes, proceeding from the upper part of the first compartment, to the lower part of the second; and in the same manner from the second to the third, the third to the fourth, and so on.



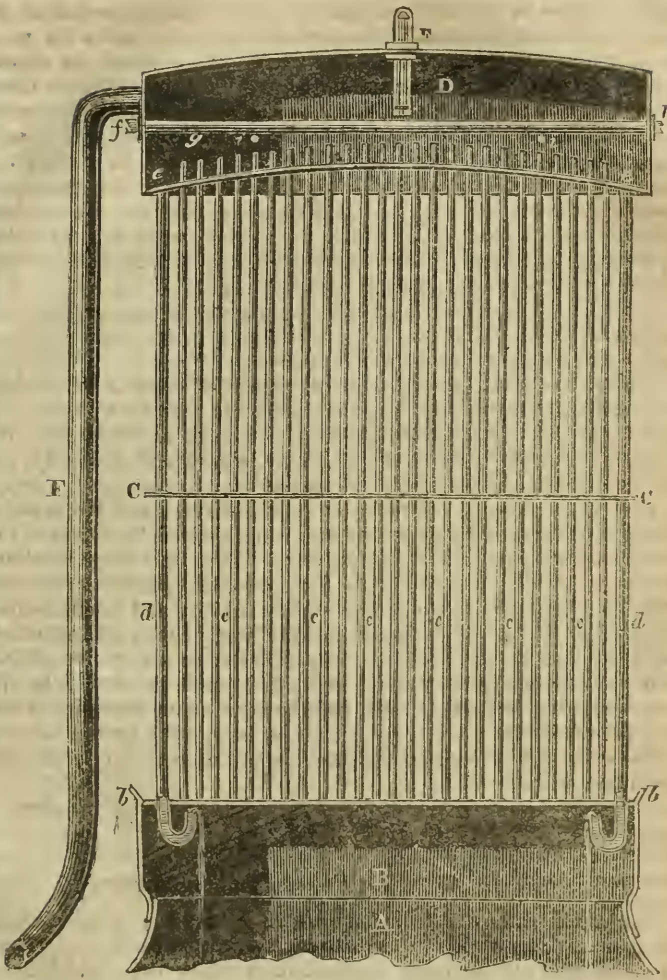
It will now be readily seen that the most aqueous portion of the vapour will be condensed in the first compartment, while the more volatile passes into the second, where another portion of the vapour assumes a liquid form; the more volatile, will still proceed to the third, and from thence to the fourth, fifth, and sixth, according as the spirit is more or less divested of aqueous particles; all depending, of course, upon the degree of heat employed in the furnace for raising the vapour in the still *m*, and to the degree of coldness of the water surrounding the condensing vessels. To ensure, however, the condensation of all the vapour, a tube *g* proceeds from the upper part of the sixth compartment, rises to a considerable height, then takes a horizontal course, and finally descends into a spiral worm placed in a tub of cold water, where, making a long circuitous passage, it is delivered from the bottom into a receiver, in so concentrated a form, as to be nearly in the state of pure alcohol.

At the bottom of the cylindrical vessel *s*, a separate short pipe, with a cock, proceeds from each compartment leading into the long pipe *u*, which being also furnished with a cock at either end, the spirit contained in any compartment may be drawn off distinctly; the contents of any, or all the compartments, may likewise be drawn off by the pipe *u*, into the vessel *o*, for re-distillation; and the vessel *o* may be discharged back into the still, when desired, by means of the pipe *v*, having a cock for that purpose. Thus this very excellent arrangement and connexion of the several vessels, admits of the repetition of the processes with the utmost facility and convenience. Having said thus much in favour of this cleverly contrived apparatus, we may be allowed to mention what strikes us as a very remarkable defect, viz. the employment of *naked* fire (as it is termed) to this still, instead of the water bath, and the consequent necessity of the long perpendicular head to it, which is, at best, but a partial remedy for the evils engendered by the direct application of fire to the bottom of the still.

[*Register of the Arts.*

Description of Grimble's Patent Distilling Apparatus.

GRIMBLE'S patent distilling apparatus is said, by a person who had carefully examined it in operation, to surpass, particularly from its simplicity, all the other improvements which have lately been introduced into the art of distilling; it requires less attendance than stills with the common head, and is under more control, as in case of running too fast, it can be easily checked; a quantity of fuel less than ordinary, is declared to be necessary to work it, and the whole charge may be drawn off without making any feints, without bringing over any of the gross oils, nearly 60 per cent. over proof. The spirits, it is asserted, are more pure at one distillation, than with three in the old mode. In malt distillery the saving is very great, as it appears that only one distillation is required, to produce very pure spirit, from the raw wash. This still is in use in Mr. Booth's distillery in London.



Reference to the Engraving.—A is the still, B the bottom box of the apparatus fitting on the still, *b b* a plate of copper fitting on the box, B; *c c c c* are open tubes through which the vapour ascends into the top box D, where the separation of the spirits from the aqueous vapour, takes place; the tubes *c c c c* project through the bottom plate of the box D, so that the oily and aqueous matters are not allowed to impede the fresh vapour from the still, but run back into the still down the larger corner tubes, *d d*, which are on a level with the bottom plate at *e e;* the lower ends of these tubes are turned up syphon wise, to prevent the ascent of the vapour from the still; C C is a stay plate for the tubes; in the box B is a range of tubes *g g g* through which a jet of cold water is passed when the spirit is required very strong (but not generally used) having its egress and exit at *f h*; F is the pipe that conveys the spirituous vapour into the worm tube. The whole operation appears to be governed by the thermometer E; and that spirit of great purity will be obtained in this way, will be obvious to every one. [*Ib.*

FRANKLIN INSTITUTE.

Fifteenth Quarterly Report of the Board of Managers of the Franklin Institute of the State of Pennsylvania.

Philadelphia, October 18th, 1827.

The period has now arrived when it becomes the duty of the Board of Managers of the Franklin Institute, to meet their constituents, and to present to them their Fifteenth Quarterly Report; a duty which, upon the present occasion, they perform with particular pleasure, as they anticipate that the information which they have to communicate, will be acceptable to the members generally.

The fourth annual exhibition was opened, in the Masonic Hall, on the fourth day of the present month, and closed on the eighth; in consequence of the inclemency of the weather, the committee of arrangement found it expedient to postpone its commencement one day beyond the time appointed. The committee of premiums and exhibitions, have obtained from the respective committees appointed as judges of the articles exhibited, their particular reports; an abstract of which is presented in their general report, which also contains the award of the premiums, in conformity with the conditions published in their last address.

The opinion heretofore entertained, of the utility of such exhibitions, has been strengthened, and confirmed, by the uniform result of the experiments which have been made; and although in the war of conflicting opinions and interests, excited by the preference which must necessarily be given to an individual, in deciding upon the respective claims of competitors, some are offended, and refuse again to enter the lists, new combatants appear, and supply their places, whilst time and reflection suffice, in general, to subdue that momentary irritation which disappointed hope is so apt to produce; and new exertions are made, on the part of many, who, for a period, thought of withdrawing from the contest. Although in the late exhibition, the manufacturers of goods of several kinds, neglected, or failed, to supply specimens of the productions of their establishments, there were many articles which were new, and a striking evidence was afforded, of great improvement in quality, and finish, in the kinds heretofore furnished.

The beneficial effects of the small charge made for admission, were universally felt and acknowledged. The rooms were well filled, without being so crowded as to interfere with a satisfactory examination of the various articles; and although members accompanied by two ladies, and depositors of goods, had free admission, there was received for tickets at 12½ cents each, the sum of seven hundred and thirty-eight dollars, 21 cents. This small charge, therefore, whilst it suffices to keep out the mere idler, will also enable the Institute to extend its usefulness, by offering premiums for a greater number of useful products. The board have witnessed with pleasure the unremitted attention of the gentlemen who were appointed as managers of the exhibition. The task imposed upon them required extraordinary exertions and sacrifices, demanding the whole of their time and attention, not only during the exhibition, but also for several days prior, and subsequent to that period; the order observed, and the neatness and taste displayed in the arrangement of the whole, testified how faithfully they performed the gratuitous task.

The requisite arrangements have been made for the opening of the drawing school, and for the delivery of the lectures for the ensuing season. Mr. Hugh Bridport will continue his superintendence in the former department; his coadjutor, Mr. Haviland, has resigned, in consequence of his other avocations demanding his frequent absence from the city. The board, however, have a prospect of immediately filling the vacancy, by the appointment of a gentleman eminently qualified for the station.

Professor Jones will deliver his course of lectures on Mechanics, and Natural Philosophy, and Dr. Franklin Bache, his on Chemistry, with its application to the arts.

The lectures will commence on Tuesday, the sixth of November, when Dr. Jones will deliver an opening address, and on the Thursday following, Dr. Bache will give an introductory to his course of Chemistry; after which, Dr. J. will lecture every Tuesday, and Dr. B. every Thursday evening, at half past 7 o'clock. Saturday evening is reserved for volunteer lectures.

In the last quarterly report, the regulations adopted respecting the admission of boys, were made known to the Institute; at a late stated meeting, the Board resolved to issue tickets for the admission of ladies to all the lectures, at two dollars for the season. The practice of admitting females to attend the courses of lectures in Mechanics' Institutions has obtained in London, Glasgow, and other places, and has been found to produce all the good consequences anticipated from the measure; affording to those who are our earliest and most influential instructors, a mass of useful information, through the pleasing medium of rational amusement; whilst their presence stimulates to exertion, and tends to the promotion of order and decorum during the hours of meeting.

In the formation of new institutions, there are, generally, a considerable number of persons who enrol their names on the list of members with a view of affording temporary aid, without designing to become permanent subscribers; owing to this, and other causes, there has been a considerable number of resignations presented during the last recess; but there has recently been a large accession of new members, and the board confidently believe, that the places of those who have retired, will be more than filled, by such as will consider themselves permanent supporters of the Institute.

The arched girders have been removed from the rooms in the first and second stories of the Hall, and pillars have been placed under the straight girders; by this means the most perfect security has been attained, and the rooms have been much improved in their appearance; the new arrangement will likewise, it is believed, give more distinctness to the voice when these rooms are used for public speaking, a purpose for which they are both intended.

The report of the Treasurer, exhibits a balance in hand of 1215 dollars, 39 cents; and it appears that a large amount remains due from delinquent members, and as it is desirable that a correct estimate should be formed of the annual income of the Institute, in order that the disbursements may be regulated accordingly, the board have resolved that it shall be the duty of the treasurer to report, at every annual meeting, the names of all such members as refuse to pay their arrearages.

Accepted by the Institute.

James Ronaldson, *President.*

Thomas P. Jones, *Secretary.*

On improving the Colours of Agates, and on an improved manner of using Florence Oil Flasks. By Mr. I. Lukens, *Engineer.*

There are certain parts of agates which have the property of imbibing oil, and other fluids, in a similar manner with the Turkey oil-stone. Mr. Lukens having been applied to by a lapidary in the United States, to learn whether the colours of the common agates might not be heightened, so as to resemble some beautiful specimens he produced, availed himself of the above property, and accordingly caused several of the German agates to imbibe oil, by steeping them in it for two or three hours; he then wiped their surfaces clean from the oil, and placed them in sulphuric acid, which he put into a Florence oil flask, and heated over a charcoal fire, until sulphurous acid fumes were extricated in abundance. He then, after suffering the whole to cool, and washing off the acid with water, found that the agates had partially imbibed the oil, and that the sulphuric acid, in its turn penetrating them, had, by carbonizing the oil, considerably deepened the colour of those parts so impregnated with oil, had rendered the veins more white and opaque, and had thereby *very greatly increased the beauty, and consequently, the value, of the stones.*

Mr. Lukens has kindly repeated this experiment before us, and has likewise given us permission to make his process known to the public; and it may also be desirable to describe his very simple and convenient apparatus used on the occasion.

Instead of converting the Florence oil flask into a capsule, as usual, he perforates the side of it with an oval hole, large enough for the introduction of the agates, thus leaving the neck of the flask to serve as a very convenient handle to lift and carry it by.

He perforates the flask by heating a part of it with a hot iron, and wetting it until a flaw is made, which, by means of the heated iron, he leads around in a proper direction to form the hole.

His furnace consisted of a small garden pot, about five inches deep, and four wide, and placed upon a larger pot, inverted; the hole in the bottom of the smaller pot being placed over that in the centre of the bottom of the larger one. He had also perforated the side of the small pot in several places, with holes of three quarters of an inch in diameter, by holding it against a drill, fixed and turned in his lathe. This pot he partly filled with charcoal, and then laying upon the charcoal a few fine wood shavings, and kindling them, he laid more charcoal upon the kindled shavings, and, by the help of bellows, quickly ignited the whole mass of charcoal. A thin metal plate, having a circular hole of three inches in diameter in its centre, and laid upon the top of the garden pot, thus converted into a furnace, supported the Florence flask and its contents, in a very convenient manner.

We like to record these cheap, very simple, and useful expedients, as they may serve to show how easily a chemical apparatus, necessary in a great variety of operations, may be formed, even of the commonest vessels, in the hands of a scientific individual; the whole cost of the apparatus would not, probably, exceed sixpence!

[*Tech. Rep.*

On Purifying Coal Gas. By Mr. WILLIAM MATTHEWS.

SIR—The art of gas lighting having now become, in a great degree, a national concern, every effort to improve it may be considered as an endeavour to benefit the public. But circumstances may perhaps have given me a predilection in its favour, as I happened to be one of those who had the pleasure of witnessing Mr. Murdock's splendid display at the Soho, near Birmingham, in 1802, and afterwards some of Mr. Winsor's exhibitions in London. As I then anticipated that its application would eventually be extensive, so I have attentively noticed its progressive advances, and have hailed, with no ordinary interest, every attempt, however trivial, that in the least degree conduced to its improvement.

At an early period of its use, the purification of coal gas was one of the chief difficulties that attended its processes; but these have long been obviated by the exertions of a few eminent and scientific men. I have seen an account of a process recently introduced at the Birmingham and Staffordshire gas works, on the principle of a patent lately obtained there; I sincerely hope that this improvement will prove to be *new*. But I presume you are aware that the purification of coal gas, by ammoniacal gas, has long been practised; for a patent for purifying coal gas upon this plan was taken out in 1817, by Mr. Daniel Wilson, of Dublin; and his specification, with a representation of his apparatus, will be found in vol. xxxii. p. 11, of the Repertory of Arts. Perhaps the new method of purifying is an improvement on Mr. Wilson's. It is stated in a late periodical work, that "Mr. B. Cook, of Birmingham, recommended the use of lime in 1810;" but I have no recollection of ever reading, or hearing, of such a circumstance before; and if it be a fact, it has escaped my observation. I have reason to believe that Mr. Murdoch purified coal gas with lime, in various ways, twenty-five years ago; and Dr. Henry notices the washing it with lime-water, in his paper, published in Nicholson's Journal for 1805. Where, however, ten tons of lime per day are used, I am rather curious to learn; the Chartered Gas Works are on a larger scale than any other in the world; and, no establishment being conducted with greater ability, the skilful superintendents of that very extensive concern must, I presume, have read, with not a little surprise, this account of the quantity of lime, as well as some other things in that paper. But I am disposed to suspect that the patentee has been deceived by his informants; for, being acquainted with his character, I am confident he is too candid and honourable a man to publish, knowingly and intentionally, any exaggerated or erroneous statements. To excite attention to an important object, to correct mistakes, and, if possible, to obtain accurate information, are my only motives for writing the above remarks, and your insertion of them in your *Technological Repository* will oblige, sir,

Yours respectfully,

To T. Gill, *Esq.* W. Matthews.

[*Ib.*

ESSAYS ON LITHOGRAPHY.—No. IV.

Retouching Ink.

It sometimes happens, particularly in designs made with the pen, that the ink with which they are drawn, has penetrated the stone but slightly. In this case, as the printing ink, which is applied by the roller, does not adhere sufficiently to the slight drawing made upon the stone, an ink is used, called by the Germans, *Anneme farbe*, and which unites with, and penetrates more deeply into, the traces made so superficially on the stone. This ink is composed of equal parts of linseed oil, suet, and soap, half the quantity of wax, and a little lamp black; the whole is melted and mixed well together, and oil of turpentine added to it, when it is desired to make it more liquid. After having prepared the stone, and covered it with gum water, a little of this ink is taken, and, by means of a clean linen cloth, rubbed lightly over every part of the writing, or drawing, taking care that it does not cover those places on the stone, which are intended to remain white. The gum water does not prevent the ink adhering to the lines of the drawing, but it does not allow it to stick to those parts which are not covered by the lithographic ink with which the designs are made. If, notwithstanding this, parts of the stone become blackened, the spots are removed by pressing on them with the end of the finger, or the palm of the hand, which has been previously dipped in strong gum water. The stone is washed with one sponge, and wiped lightly with another; it is then inked with the roller, and the impression taken.

On the Paper, and the mode of wetting it.

The kind of paper to be used in lithography, is not a matter of indifference, particularly when impressions are to be taken from a highly finished crayon drawing. The paper is the better for being thick and soft, especially if it swells, so as to prove elastic in the process of printing. The impressions come out best on unsized paper; that, however, which is thin, and sized, may be used for drawings in ink, or for writings. A waste sheet of paper is always placed on that which is to receive the impression; and when it is thin, even two are used, in order to produce an impression more perfect and regular. Sized paper requires to be wetted more, and to remain in that state longer, than that which is not sized; but it affords, in general, fewer impressions. That which is impregnated with lime, alum, or other substances of a similar nature, spoils the beauty of the impressions, and prevents the taking many of them. They are likewise injured by folds, and bulbs, in the paper, but more particularly by particles of sand: these last form lines on the drawings, cut the leathers of the presses, and make hollows in the scrapers, rendering them unfit for use. The paper ought to be of a uniform and regular texture, and thickness. In order to wet the paper, one or two sheets are taken at a time, by the two corners of one end, and drawn through a shallow tub, full of clear water; they are then laid carefully on five or seven dry sheets, and covered with an equal number; continuing thus alternately to place together wet and dry paper, taking more or less of one, or of the other, according to the nature of the paper. The whole is placed between boards, on which weights are laid, in order that the moisture may be equally diffused throughout it; more weights are added at the end of an hour, or, what is still better, the paper is put into a press. If it be desired to take an impression without delay, and there is no moistened paper prepared, some may be soon procured by damping one side of each sheet, with a sponge slightly moistened, and pressing the whole for a few moments. When the drawings are made with ink, the impressions may, on an emergency, be taken on dry paper; but in this case, it must be sized. The moistened paper of which we have just spoken, should remain under pressure for ten or twelve hours—it may be continued in this situation, for twenty-four hours; but if it remain longer, it will dry, and become mouldy. Whenever it is found that the impressions cannot be taken until the expiration of this time, the paper must be removed from the pressure, dried in the air, and wetted again when it is wanted for use. When the paper is too wet, it does not take the ink well, and yields inferior impressions, and, moreover, has the disadvantage of sticking to the stones. Experience will soon teach the degree of moisture which ought to be given to the different kinds of paper which may be employed.

Manner of Outlining the Drawings upon Stone.

Tracing, facilitates and abridges the work; and it is indispensable when it is desired to produce a fac-simile, or to obtain, with the least trouble, a copy of a drawing, the impressions of which are wanted to stand in the same direction as the original. In this case, a transparent paper is taken, such as is known in commerce as *papier végétal*, or any other kind, that is free from those fatty or resinous substances, which may dirty the stone, by taking the printing ink. This paper is laid on the model, and the outline and other principal lines of the design are traced with a lead pencil, or, what is still better, with red chalk, which leaves more visible traces on the stone. The outline, thus obtained, is placed on the stone, which has been previously rubbed with a little spirits of turpentine, or slightly moistened with water; it is then covered with a sheet of paper, and subjected two or three times, to the action of the press. The lines made on the paper, will, by this means, be reproduced on the stone, and serve to guide the artist in his design. It is not necessary to endeavour to efface any of the marks of the crayon which may appear after the drawing is finished, as they will not injure the impressions in the least. When it is of no consequence obtaining the impressions in the same direction with the original drawings, and there is no press at hand, the outline may be obtained on the stone, by rubbing it, on the reverse side, with red chalk, or with plumbago pounded and sifted. It is then fixed on the stone with wafers, and the lines which are to be transferred to it, are passed over again with a blunt point. If it is wished to avoid colouring the reverse side of the outline, a sheet of tissue paper is interposed between it and the stone, which paper has been coloured with red chalk on the side which is to be placed next the stone. By so doing, and then tracing the outline with a point, it is made to appear on the stone. This mode may be employed for *fac-similes*, and for all kinds of drawing; it being only necessary to retrace the lines already made, either with ink or crayon, as is done with a point, or a graver, in working upon copper.

On the Precautions to be Observed in Writing, or Drawing, upon Stone.

When it is desired to write, or to draw with ink, immediately on the stone, either when the sketch has been obtained by transfer, or traced by hand with a crayon, we proceed exactly as we are accustomed to do when we work on paper, whether we use the pen or the pencil. We would remark, however, that practice and a certain lightness of hand are necessary, in order to make, with facility, neat and delicate lines on stone. Highly finished works should not be undertaken without previous practice. The ink takes better, and spreads less, when the stone has been well polished, and rubbed with spirits of turpentine, or with water, a little soapy; the former, however, is preferable. When the stone is rather soft, there should be mixed with the spirits of turpentine, a little of the lithographic ink; and with this the stone is to be slightly rubbed with a linen cloth, until it acquire a grayish tinge. The artist should be provided with steel pens, pens for drawing lines, and sable pencils, of different sizes, according to the kind of work to be done; each person choosing that instrument, with the use of which he is most familiar. It is necessary in both cases, to have the lithographic ink, so thick, as that the lines made on the stone may be of a deep black, and still thin enough to flow with sufficient freedom from the pen. It should be about the consistence of thin cream. If it is too liquid, it may be thickened by rubbing in it a stick of ink; if, on the contrary, it is too thick, a few drops of water may be added to it, mixing them by shaking them together in a bottle. It is necessary to the beauty of the impression, that all the lines of the design should be drawn with the same intensity of colour. The ink often forms into a little mass on the end of the pen, in consequence of its thickness, or of certain particles which have rubbed up from the stone; it is necessary, when this is the case, to wipe the pen with a rag, or it may be sufficient simply to rub the sides of its point against the vessel which contains the ink. It is well also, always to try it on the edge of the stone, in order to avoid the danger of making thick, slovenly lines, in the design.

Beginners find a difficulty in making the ink flow, when attempting to draw on stone, with a steel pen, or a ruler; but this difficulty is soon overcome by practice and patience, if the instruments used are good. The use of the pencil is more easy, though less expeditious, than that of the pen. All that is necessary, is to keep it supplied with a small quantity of ink, and to work with a light hand, taking care not to repeat the strokes. When the ink has thickened in the pencil, it should be wiped, and fresh ink taken.

It is easy to perceive, that when it is desired to write on stone, the characters must be reversed, and the work done from right to left, in order to have the impressions in the direction of ordinary writing. This is an art which cannot be attained without a certain apprenticeship, while writing on paper with lithographic ink, may be done by all who know how to write.

Drawings in crayon do not require less care than those in ink. They ought to be executed with a free, bold, and strong touch. If the crayon be passed lightly over the stone, it will produce pale lines, which will often be lost in the printing; and it is in vain to endeavour to give strength and effect to these, by going over them a number of times: the succeeding touches, as well as the first, being made faintly, and with indecision, will fail to adhere to the stone, and will disappear, or become coarse and confused.

It is necessary to be very careful to work on stones that are perfectly clean, whatever may be the kind of design which it is desired to execute. Negligent workmen often neglect to wash the stones carefully, so that they may be sometimes found covered with a slight coat produced by the material used in the polishing. It is necessary, also, to wash them well with a clean linen cloth, before using them, in order to remove the dust with which they may be covered. They may likewise be rubbed with a cloth, moistened with spirits of turpentine. A paper should be placed under the hand, so that it may never rest on the stone, and great care should be taken, that the design be not rubbed; in order to avoid the danger of this, the hand should rest on a wide ruler, supported by two little strips of wood, as has been before explained.

It is more convenient, when drawing with crayons, to cut a number of them before beginning to work, so as always to have some ready at hand, for which to change that in use, when it has become blunt, or has softened by warmth, without being perpetually interrupted in the work. Besides, if the crayons are cut over the stone, it may be soiled by the little fragments, which would adhere to the design, be broken up in the printing, and produce dark spots. Little pieces often become detached from the crayons, in the act of drawing, and may be discovered, by examining the stone against the light, in an angle of about 45 degrees. In this case, it is necessary to remove them carefully with the point of a knife. When these little pieces are perceived on the point of the crayon, they may be removed by turning the port-crayon round and round between the fingers, and rubbing the point of the crayon on the edge of the stone, or on some other substance.

When drawing on stone, it is necessary to be very correct; for every line once made, will be reproduced, unless it be erased, which it is difficult to accomplish. There is no other means of doing it, than by using the point of the scraper. If the drawing is in ink, the part which it is desired to correct, must be obliterated with the scraper; and in order to prevent the ink leaving any trace, it is sufficient that the stone should be cut very superficially, and without producing a hollow in it, or taking off its polish; but leaving it so that the new lines may be made on the same place. Those lines which are too thick, or ragged, are corrected by means of the same instrument.

The difficulty is greater in correcting a drawing in crayons, done on a grained stone; for if the grain has been removed with the scraper, it will not be found possible to use the crayon on those parts which have been thus polished. In this case, it is absolutely necessary to make use of the point of the scraper, or of some other sharp instrument; with this, those tints which are too deep and strong, may be softened, and the harmony of the different parts of the drawing, restored. Those parts which have been blackened by the crayon, may be removed by picking with a point, without injuring the grain of the stone. When it is wished completely to remove any part of the drawing, the point of a scraper will not answer the purpose; in this case, it is necessary to erase it, by placing some sand on it, and rubbing it about, with a mullar. The crayon is thus removed, without destroying the grain of the stone; and after having cleaned this part with a brush, and rubbed it with a piece of linen, the drawing may be again made on it. The same method is employed, when, by accident, a spot of ink, of grease, or of saliva, has fallen on the stone.

ON GILDING.

We gave, in our last number, the French mode of gilding in oil, and we now furnish, from the same source, (the *Dictionnaire Technologique)* that of the ordinary gilding upon wood, such as is seen upon looking-glass and picture frames. We shall hereafter publish the method followed in England and in this country, which differs somewhat, though not materially, from the following.

On Gilding on Wood, &c. with water-size.

This branch of business requires a workshop which is equally protected from the intense heat of the sun, and from the extreme cold of winter. Low and moist situations must also be avoided, as the vapours which are generated in such places, such as the sulphuretted hydrogen, and ammoniacal gases, are peculiarly injurious. Those persons whose breath has a strong and disagreeable odour, ought not to attempt this kind of work.

The seventeen operations which follow, are necessary in this gilding, and some of them must be several times repeated; we shall describe them as briefly as the subject will admit.

1st, *Sizing.*—A good handful of the leaves of wormwood, and two or three heads of garlic, are to be boiled in a quart of water, until the liquid is reduced to one half; it is then to be strained through a cloth, and half a handful of common salt, and nearly half a pint of vinegar, are then to be added to it. The design of this composition, is to destroy the greasy nature of the wood, to prepare it the better to receive the coats which are to be laid on, to preserve it from being eaten by worms, and to kill any which may be there; this, mixed with a sufficient portion of good glue, boiling hot, is to be laid upon the wood, with a brush, the bristles of which are short.

When it is wished to gild plaster, or marble, the same composition is used, but without the salt, as in damp situations, this would produce a white saline efflorescence upon the surface of the gold. For wood, the salt is absolutely necessary. Two coats of this size are to be laid on, the first of which should be weak, that it may sink into the plaster, or the marble, and moisten it perfectly; the second coat should be of strong size.

2. *The White Coating.*—The wood which has been sized, is to have six, eight, or ten, layers of Bougival white, commonly called Spanish white *(whiting);* so that the faults in the wood, and in the carving, may be filled up; taking great care that the projecting parts be well covered with the white, as the beauty of the burnish on the gold depends much upon this. The following are the precautions necessary in laying on the several coats.

A quart of strong parchment size, and half a pint of water, are to be made quite hot: and to this are to be added, in small portions, two good handfuls of the whiting, which have been passed through a fine silk sieve: this is left to infuse for half an hour, when it is to be stirred carefully, so that the mixture may be perfect; the first coat is to be laid on quite hot, dabbing it with the brush, in such a way, that it may not be thicker in one place than in another. The lower parts of the carving must be covered by dabbing in with a smaller brush: this first coat is not only to be laid on equally, but it must be thin, so that the wood may be seen through every part of it. The operation of dabbing with the brush, must be repeated in every successive coat, in order to unite the whole, so that they may form a single compact body. Experience has shown that when this is neglected, the whiting will scale off in separate layers.

The coats of white which follow that first laid on, are prepared in a similar way; the size, however, is used very strong, without the addition of water; it may be used cold, but the mixture must be well made. The last coat must be perfectly dry, before a new one is laid on; the quantity applied should be always equal, and the same strength preserved in the size; without this latter precaution, a strong, superior coat, will cause the weaker one below it, to scale off. The last coat should be laid on a little warm, and rather thinner than the others, brushing lightly to soften the work down.

3. *Stopping and Fish-skinning.*—After putting on one coat of white, and before it is followed by a second, the work must be examined, the lumps reduced, and the small hollows filled up; this latter is to be done by a cement consisting of whiting and glue kneaded together; after which, it is rubbed with fish skin, which will remove all the fibres of the wood.

4. *Stoning, and Smoothing.*—The whitened surface is to be wetted by the brush which is used for putting on the whiting; the water should be fresh and cool, and in summer a piece of ice should be thrown into it; only a small portion should be wetted at once, which should then be rubbed down with pieces of pummice stone, made flat for the parts which require to be of that form, and round, or hollow, as may be necessary for the mouldings; little sticks are used for clearing out those members of the mouldings, which may have been filled up by the whiting: the whitened parts are to be rubbed lightly, so as to render the surface smooth and even, to the touch. At the same time, a brush which has become soft, by using it with the whiting, is employed to wash out all the dirt which has been formed in the rubbing; the moisture is to be dried up with a sponge, and any small grains which may remain, may be removed by the finger; this operation is delicate and important; the whole work is finally to be wiped with a piece of clean linen. In the finishing operation, particular care must be taken that the square members and grooves are perfectly even, and that the corners are finished so as to form good mitres.

5. *Repairing.*—The work having been softened, stoned, and dried, is given to the repairer, to restore to the sculptured parts the fine and delicate cutting of the chisel; this is called recutting, and repairing. This labour ought to be performed by a skilful workman,

who is able to reproduce on the whiting, all the characteristic traits of the sculpture.

6. *Restoring.*—This is restoring to the whiting its original properties; which is accomplished by passing a moistened cloth over the parts which are to be matted, or burnished, and a soft moistened brush over those which have been repaired; then washing the whole with a soft piece of sponge, removing carefully, every speck, and every hair.

7. *Polishing with Rushes.*—The parts intended to be coloured yellow, are to be rubbed with rushes, after restoring, and drying; that is, all the even parts are to be smoothed by them, taking care not to rub off the whiting.

It has, for a number of years, been the practice to substitute *bas reliefs*, formed in moulds, for the sculptures formerly used, and which, when gilt, have the same appearance. The process of making these is the following: Moulds of plaster, or, which is better, of sulphur, are employed, which have the required figures in reverse; these, after being greased, are filled with a paste formed of whiting, kneaded up with size. This paste is to be strongly pressed into the moulds, with the fingers, so that a perfect impression of the sculpture may be obtained; that portion of the paste not contained within the mould, is to be removed with a straight, blunt edged instrument, which will leave the back surface even; the moulded part is then suffered to dry sufficiently to protect the figure from injury, but not so as to lose that flexibility, which is requisite to its being applied to a surface either convex, or concave. When thus prepared, it is to be glued in its place, pressing it down with cotton. The frames which are now manufactured, are all ornamented in this way, which is very economical, and produces a better effect than carved work, the figures being more uniform, and not requiring the operation of *repairing;* these moulded figures being affixed after all the preceding processes have been performed.

8. *Colouring Yellow.*—This is giving a yellow colour to the work prepared for gilding. Half a pint of parchment size is taken, which must be clean, white, and as clear as crystal, and of one half the strength of that used for the coating with whiting; this is warmed, and there is mixed with it, two ounces of yellow ochre, very finely ground in water; it is then left at rest, and the clear portion decanted, which gives a fine yellow colour; this is to be applied very hot, with a soft, clean brush, so as to cover the whole work. This application must be lightly made, so as not to disturb the whiting. The yellow tint serves to cover those deep recesses, into which the gold cannot be made to enter; it serves also as a mordant for the gold size.

9. *Graining.*—The yellow colour being dry, the whole surface is to be again gently rubbed with rushes, to remove all specks or hairs which may be found on it, and to give a uniform surface, without the slightest inequality.

10. *Covering with Gold size.*—The gold size is the composition upon which the gold is to be laid; it is composed of one pound of

Armenian bole, two ounces of red chalk, and a sufficient portion of English black lead, ground separately in water. The whole is to be mixed and reground, with nearly a spoonful of olive oil. The beauty of the gilding depends greatly upon the making, and the proper management of this size.

The gold size is tempered by mixing it in parchment size, which is clear and clean, and has been passed through a fine sieve, to remove all foreign matter. This, when applied, is made warm, and three coats of it are laid on with a small brush, the bristles of which are fine, and long; such brushes are made for the express purpose, with very soft hair. All the parts which are either to remain matted or to be burnished, are to be covered with the size, but it is not to be forced into the deeper parts.

11. *Rubbing.*—When the three coats of size are quite dry, the larger smooth parts, which are to appear matted, are to be rubbed with a piece of new dry linen; this will cause the gold which is not to be burnished, to extend itself evenly, and to appear brilliant; and the water to flow over the sized surface, without forming spots.

Upon those parts which have not been thus rubbed, but which are to be burnished, two additional coats of the same gold size are given; tempered in the same way, and to which a little water has been added, to render it thinner; the work is then ready for gilding.

12. *Gilding.*—A book of leaf gold is taken, the leaves are placed upon the cushion, cut to the required size, and applied in their proper places, by means of hair pencils of different sizes. The work is wetted with water, which must be perfectly fresh and clean, and which should be changed every half hour, and in summer, cooled by ice; the wetting is confined immediately to the part where the gold is to be laid; and the deep recesses should be gilt before the more prominent parts.

The leaf being deposited in its place, water is applied by means of a pencil, behind it, so that it may not flow over its surface, as this would occasion spots, particularly on those parts which are to be burnished; this water allows the leaf to spread, whilst its edge is to be supported in its proper place; it should also be breathed on gently; and the waste water removed with the point of a pencil, as it would otherwise dissolve the size, and the coats of whiting beneath it.

13. *Burnishing.*—That is, giving a brilliant appearance to the gold, with an instrument called a burnisher. This article has been described under the head of BURNISHING. (Vol. ii. p. 290.)

14. *Matting.*—This consists in giving a light coat of parchment size to those parts of the gilding which are not to be burnished; this prevents the rubbing off of the gold. The size ought to be warm, but not hot; its strength should be half as great as that used with the yellow colour. It should be but once applied, allowing it to reach the deeper parts of the sculpture, which will mat, and retain the gold in its place.

15. *Retouching.*—It sometimes happens, in gilding, that there are small spots, on the deeper parts, which have been overlooked, or

from which the gold has been removed in applying the matting size; upon these places small pieces are to be put, by means of a pencil, after having moistened them with a small brush; when dry, each of these spots should be covered with a little size.

16. *Vermillioning.*—This consists in giving a brilliant red colour, which, by its reflection, produces the appearance of *or moulu.*

The *vermeil* is a liquid which gives to the gold a warm reflection, and causes the work to appear as if gilt in *or moulu.* The following is the composition used: two ounces of annotto, one ounce of gamboge, an ounce of vermillion, half an ounce of dragon's blood, two ounces of salt of tartar, and eighteen grains of good saffron: the whole is to be boiled in a quart of water, over a slow fire, until it is reduced one fourth. The liquor is then passed through a strainer of silk, or muslin.

A small fine pencil dipped into the vermeil, is to be lightly passed, with judgment and taste, into the indentations, and such other parts, where it will, by being reflected, give a good effect to the gold.

17. *Repassing.*—A second coat of the matting size is to be passed over the matted parts; this should be applied hotter than at first, and serves to bind and finish the work.

This is the manner of gilding in burnished gold, when the work is well performed. The processes which we have given are correct, and are all requisite, and indeed indispensable to perfectly good work. They are frequently sacrificed to ignorance or avarice, in order to save trouble, or to increase the quantity of goods produced; gilt articles of all prices are sold every where, but it is easy to discover those which have been executed under the influence of ignorance or of roguery.

Notice respecting Magnetic Polarity. *By* D. H. Barnes.

TO PROFESSOR SILLIMAN.

New York, April 16, 1827.

Dear Sir—Professor Eaton's demonstration, of the fact, that the fitful variation of the compass is caused by the magnetism of the card, gave us great pleasure, and the simple and efficient remedy which he has found, is no less honourable to himself than beneficial to the community. Mr. Patten, of this city, had discovered the same fact in a compass which he had proscribed as unsaleable, and laid by as useless. Trying this compass with its proper needle, we observed that in turning the compass slowly and steadily around, there was one point to which the needle would cling, until the compass was turned full ten degrees. The needle would then start off, suddenly, to the proper point, and traverse correctly until again interrupted by the point of attraction in the rim. The same compass was then tried with a *short* needle, which lay perfectly still, and pointed with the utmost exactness, while the compass was turned entirely round. While trying these experiments, Mr. J. Dodge of the Western High

School of Rochester, took the [iron?] window bar which lay near it, and placing it perpendicularly, found that the *lower* end was a north pole. He inverted the bar, and was surprised to find the *same* result, that is, the poles were *instantly changed by inverting the bar.* He invited me to try the experiments with him. I did so, and after verifying the fact of the instant inversion of the poles, by the change of the position of the bar, I was led to inquire at what degree of elevation this change takes place. There must be some point at which the poles first become inverted, and there must be some *neutral* point or medium between polarities directly opposite. The idea struck me so forcibly that I immediately set about a series of experiments, which produced the following results.

Experiment 1. An iron bar was laid on the meridian due north and south.

Result. It showed strong polarity.

Exp. 2. The *south* end was raised to the Zenith.

Res. No change took place. The needle at the bottom was steadily attracted as before.

Exp. 3. The top of the bar was carried over from the Zenith to the north point of the horizon.

Res. The needle was inverted.

Exp. 4. The *north* end of the bar was raised to the Zenith.

Res. The needle was inverted.

If then, the bar raised from the *south*, traverses through 180 degrees, and becomes inverted; and the same bar raised from the *north*, traverses through 90 degrees, and becomes inverted, the changing point must *divide the difference;* accordingly—

Exp. 5. The *north* pole was slowly raised, in the progress of which the needle quivered, became unsteady, and at 45 degrees was inverted.

Again, if the needle is *inverted* at 45 degrees there must be a neutral point, and this again must *divide the difference;* accordingly—

Exp. 6. The north end of the bar was raised to 22½ degrees;

Res. It exhibited no signs of polarity, being from end to end simply an attracting point to either end of the needle.

Exp. 7. The bar was laid due east and west, or at right angles to the meridian.

Res. It exhibited no signs of polarity.

I anticipated the next conclusion, that the change of polarity would *divide the difference* between 45 degrees and the commencement of the scale; accordingly—

Exp. 8. Giving the compass to Mr. Dodge, and holding the instrument to measure the angle, I raised the bar from the *east* 22½ degrees, and said, without looking at it, "now the needle is inverted." "True," said he, "so it is."

The curious and interesting result then is, that a plane elevated from the north, at an angle of twenty-two and a half degrees, and cutting the horizon in a line due east and west, is a *neutral* plane or magnetical *equator*, and that a bar revolved on this plane shows no polarity; and if the bar makes with this plane on the upper or *south* *side* any angle equal to twenty-two and a half degrees or greater, the lower end is the north pole; and if the bar makes on the under or *north side* of the plane, a less angle with the plane of the horizon than the magnetical equator makes, the end which touches the equatorial plane is the south pole. Whether these results are uniform in various parts of the world, or whether there are such lines as magnetical *tropics*, on each side of the magnetical equator, as the above results seem to intimate,—whether the magnetical equator is the same in different latitudes, or varies its position according to latitude, future experiments must determine.

Dr. Gilbert has mentioned the fact, that opposite ends of an iron bar equally affect the magnet, and in the same way; and he accounts for the fact by supposing that the earth magnetises the bar instantaneously.

Is then the common remark, in the books, that a bar becomes magnetic by long standing in a vertical position, strictly true? And will not any such bar instantly change its polarity by being inverted?

Should any of these facts or experiments appear to yourself to be new or useful, they are at your service for publication in your valuable Journal.

Yours most truly,

D. H. BARNES.

We learn from Mr. Barnes, that at the time of writing his paper, he had not seen the remarks in our last number, (see page 42 of this Journal) signed, A Surveyor. He considers them as a covert and improper attempt to depreciate a valuable discovery, and as conceived in an improper spirit. In inserting them, we were not impressed with any other idea, than that a practical man was urging a fair criticism respecting an innovation requiring great caution, and which was therefore a proper subject of examination. We trust that it will be the means of producing additional experiments, and that in the end, the cause of truth—which should be the great object of all our labours—will be promoted.—*Editor.* [*Silliman's Journal.*

DENISON'S *Baltimore Patent Roofing Cloth.*

IN an early number of this Journal, we inserted a letter upon this subject, and promised to procure further information. The patentee was not satisfied with his early trials, and was convinced that experience would enable him to produce the article in a more perfect form; but experiments of this kind demand time, as this is the only perfect test of durability. In consequence of an application recently made to us, we have had some correspondence with the manufacturer upon the subject, and have received from him a specimen of the roofing as now made, and, also, such information as he possesses, respecting its value. We subjoin the letter of Mr. Denison, as more acceptable than any thing we could say, particularly as it is characterized by that candour which will bespeak the confidence of those who are uninformed respecting the high standing of the writer.

Baltimore, Oct. 13, 1827.

Dr. Jones,

Dear Sir,—I have received your polite letter relative to the roofing cloth, and am obliged by the interest you have taken in this matter, which is indeed a desideratum in the arts, or rather was one, for I am confident, that the cloth, as we now prepare it, will answer the purpose, and that effectually.

I am satisfied, both from my own experiments, and the attempts of others in the same way, that cloth prepared according to any of the methods heretofore known, will not resist the action of sun, air, and moisture, to which it must be exposed, unless it be frequently refreshed by some oily or other unctuous matter. We found that the roofs covered with the cloth as first prepared, would answer with the precaution of painting or varnishing it, once a year, at least, but not without. The cloth, as it is now prepared, so far as the experience of nearly a year's exposure can be any criterion, effectually resists the operation of the agents above mentioned, and appears, when examined after such exposure, not to have undergone any change; so that a duration of many years may be anticipated, because the influence of these agents of decomposition is progressive; and if their effects do not begin to show themselves in a year, we may safely conclude, that there is, in the matter with which the cloth is prepared, an inherent power of resistance.

The longest experiment of the new cloth, is an exposure of ten months, upon a large smoke-house, attached to a bacon establishment, on Market street, Fell's Point; which was covered on the 12th day of December last. The cloth has undergone no change, but a slight loss of freshness on the surface.

Other pieces have been carelessly laid upon a common shingle roof, so that the rain ran freely under and over them, and after remaining there between five and six months, they were found not to be in the least mildewed, or otherwise injured. The specimen sent was thus exposed for about three months.

There are several buildings covered with the new cloth, all of which answer, but the one above mentioned is the oldest experiment with the new cloth.

There are some eight or nine buildings, some of them large, as, for example, Mr. Buchanan's dying house at the Warren Factory; and three or four of my own, covered with the cloth as at first prepared, which answers, by observing the precaution above mentioned.

Independently of all this, when you come to be acquainted with the mode of preparing the cloth, last invented, you will find it altogether original, and from your knowledge in the arts, you will be satisfied, *a priori*, that it must answer the purpose. We can supply what Mr. P. may want at one dollar per square yard.

Yours, &c.

E. Denison.

We have left the specimen, above mentioned, with our publisher, Mr. Dobson, who will cheerfully exhibit it to those who wish to examine it. We should use it with perfect confidence. [*Editor.*

Remarks on Feeders for High Pressure Steam Boilers. By the EDITOR.

In the last number of Silliman's Journal, Mr. Doolittle of Bennington, Vermont, has given "A Description and Specification of a Hydrostat, or Apparatus, intended to secure a constant and uniform supply of water in Steam Engine Boilers," for which apparatus, it appears he has obtained a patent. We are at a loss to discover in what his contrivance differs from the old ball-cock, excepting in being more complicate, and, consequently, less useful. The hydrostat is a floating body which is placed on the surface of the water, and has two stems to it, which slide through holes in a frame The upper stem has a rack, which takes into the teeth of a pinion, fixed upon the head of a cock in the supply pipe within the boiler, and by the sinking of the float the cock is opened, and allows water to be forced in, by the force pump. On the outside, there is a waste valve, to admit of the escape of water when the cock is closed.

Every mechanic will see that this is a ball-cock; and every engineer is familiar with a waste valve; and knows, also, that a cock is a very uncertain instrument, when used for such a purpose, frequently getting out of order, and allowing steam to escape; valves should always be preferred in such cases.

In the Transactions of the Society for the Encouragement of Arts, &c., and also in Vol. II. of the Register of the Arts, a very ingenious apparatus is described, in which the float is made to act upon a valve, in a novel and ingenious manner. We know nothing of it in practice, but should prefer it to that described: the waste valve and tube are similar.

Many of our readers know, that an instrument, denominated a *tell-tale*, has been proposed to be added to steam boilers; it is so called, because the blowing out of the steam, through a trumpet-mouthed tube, is to give the alarm when the water has descended to a certain point. To devise a method by which this should be made to act, with certainty, against the obstacles presented by highly elastic steam, will be to confer a great benefit on the public, and great credit upon the inventor.

On a simple means of separating the Yellow Colouring Principle from Madder, and rendering it proper to afford the Red, Lilac, Violet, and Brown Colours used in Dying and Printing Wool, Silk, Cotton, and Linen. By MR. G. H. DE KURRER.

THE author states, that the treatises published by M. M. Kahlmann, Colin, and Robiquet, have determined him likewise to communicate a simple means of separating the red colouring principle of madder.

He had repeated most of the old practices, and especially that of M. Mérime. The object of these processes was, to wash the madder in order to separate the yellow colouring principle, but which also carried with it three-fifths of the red colouring matter. With a view to avoid this loss, M. Kurrer submitted the madder to maceration in pure water, and to the alcoholic and acid fermentations. He lastly washed it, until he found that the water from the washings no longer changed the colour of litmus. The madder which he obtained by this means had every desirable quality; but he found it so difficult to stop the acid fermentation, as to render the process not practicable on a large scale, and especially because this fermentation also, liberated a considerable part of the red matter.

The author finally submitted the madder to the alcoholic fermentation only, and immediately washed it. This process completely succeeded, and he applied it to all the varieties of madder, without meeting with any difficulty. The following is the description of the process:—

He employed three tubs, A, B, and C, which he placed near to each other, and in summer in the open air, under a hovel or open shed; but in winter he removed them to a cellar, the air of which he maintained at a temperature of about 18° or 20° of Reaumur.* The vessel A served to effect the fermentation in, and contained from 50 to 55 pounds of madder; it was two feet eight inches deep, and two feet six inches in diameter. The tub B, or washing vessel, was five feet and a half in height, and three feet in diameter; this was furnished with three wooden cocks, the first placed at two feet, the second at three feet, and the third at four feet above its bottom. The vessel C served as a deposit: its height was four and a half feet, and it had a cock placed at the height of a foot and a half above its bottom. In commencing the process, he placed in the vessel A, from 50 to 55 pounds of ground madder; he then added water, stirring the mixture continually, until the madder, when at rest, was covered with an inch and a half of water. He then left it at rest until the fermentation took place, and raised a crust of madder up to the surface, and which usually happened at the end of thirty-six hours, or, more tardily, in forty-eight hours, according to the temperature of the air. This is the favourable time for transferring the mass into the vessel B; and when this is done, that vessel is filled up with water; it is then suffered to remain at rest for two hours, during which time the madder precipitates. The first, or uppermost, cock is then opened, next the second, and lastly the third, and the liquor collected from the second and third cocks is carried to the tub C, in which it completes the precipitation of that madder which had escaped from the vessel B. He then continued to make two, three, or four repeated washings of the madder in the vessel B, until the washing water became no more coloured. The madder, thus purified, serves for dying, and in the manufacture of woven goods by all the known processes; but it is important, that in summer, the utmost care should be taken to prevent the madder from undergoing a second fermentation. The madder in the vessel c, after being washed and precipitated, is just as good as the other. We might, perhaps, employ the first liquor, separated from the fermented madders, with advantage, in the preparation of the heated vessels used in making indigo, or woad, as well as in the improvement of the madder. D. B. F.

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* Or from sixty-six to seventy degrees of Fahrenheit's thermometer.

[*Von Dingler's Polytec. Jour.*

Remarks by the Editor of the Technological Repository.

The Editor was some time since favoured by Dr. Dingler with some exquisitely beautiful specimens of calico-printing, produced in a manufactory in which he is concerned, and chiefly by the *discharging process*, now coming into such universal employment amongst us. The reds, pinks, and purples, were exceedingly pure and brilliant, and might possibly have been produced by treating the madder upon a plan similar to the above. At any rate, coming from such a quarter, and from so intelligent a judge as Dr. Dingler, this communication is entitled to the highest consideration amongst our dyers and calico-printers. The beautiful *self-green* produced from the chromic acid was first noticed by the Editor amongst these specimens.

Additional particulars of Mr. Perkins's High Pressure Steam Engine. By John March, Esq.

Greenwich, July 12, 1827.

Sir,—Having very recently witnessed at St. Catherine's Dock, London, the extraordinary power of Mr. Jacob Perkins's high-pressure, single-stroke, safety engine, I have the pleasure of stating a few important facts, reserving for myself a future representation of its additional advantages, my present observations having principally in view to explain some points which seem to have been much misunderstood, or, if observed, not to have been sufficiently appreciated. Indeed, it appears that the observations which the inventor has confidently made, long before the engine was first proved, have been nearly treated as mere assumptions. Any information, therefore, given to the public on so interesting a subject, will, it is presumed, prove acceptable.

The most important fact to be considered is the *perfect safety* of Mr. Perkins's *steam generators*, which may now with truth be declared to have wholly superseded the necessity of using boilers of any description, to which, however well made, must be attributed the fatal accidents so frequently recorded.

From calculations made with very proximate accuracy, it evidently appeared to me, that the quantity of water injected per minute was 266 cubic inches, being less than one gallon by 16-288ths, or 1-18th.

It becomes necessary to state, that the work to which Mr. Perkins's single engine was applied, was to pump water out of the dock now constructing; to perform which, two double engines, on the principle of Boulton and Watt, are used; one of sixteen, the other of ten horse power. As the two engines required some repairs, they were stopped, and that of Mr. Perkins was applied to perform the same work, which it has most successfully effected, by keeping the water clear; thus doing, alone, a work equal to that of the two engines; that is to say, the work of 26 horses' power. Mr. Perkins's engine, in performing this, worked with a pressure of 35 atmospheres (equal, according to some, to 525lbs., but, according to Doctor Wollaston's more correct mean, equal to 490lbs. to the square inch), with a consumption, per hour, of only one bushel of a mixture of coke and coal; and the constant rate of the engine was sixty twenty-inch strokes per minute. The coke used, far exceeded the proportion of Newcastle coal. Now, on a reference to Mr. Watt's calculation, the quantity of coal used for a 26-horse power steam-engine per hour, is three bushels; and as we may fairly conclude that this single engine of Mr. Perkins performed the duty of two engines, together equal to 26 horses; so the reduction of two-thirds of the fuel may, by a parity of reasoning, prove to be a point of the highest importance; the advantage is still further increased through the use of coke. Indeed, from the peculiar construction of Mr. Perkins's generators, coke seems much better adapted than coal, which expends itself too readily, and before the caloric can have its full action. The smoke which is observed to issue from the chimney of most steam-engines, at every fresh supply of coals, is another evil, which will be obviated by the manner in which Mr. Perkins's generators are fixed, they acting in a great measure as smoke consumers.

I most attentively made my observations during the trial of this engine; and some share of experience enables me to say, that for an experiment (for it is only an experimental engine), it may be fairly pronounced to be as conclusive and satisfactory as any that has ever been made.

I am, sir, your most obedient servant,

JOHN MARCH.

To T. GILL, *Esq.*

[*Tech. Rep.*

Note by the Editor.—We have not received any late, direct information from Mr. Perkins on the subject of his engine, but have carefully selected whatever the public Journals have offered, the whole of which has been of a favourable character. The preceding account, is of nearly the same date with those given in our last number, and serves to corroborate them. We, however, have conversed with a gentleman just arrived from London, and whose judgment upon such subjects is second to that of very few persons, and who avers, that there has not yet been any fair test of the operation of the engine, and that it will eventually be found to fall very far short of the anticipations of its ingenious projector. We shall continue to present every thing which bears directly upon the question, until it is put completely at rest.

On the mischiefs arising from the employment of Fir, Pine, and Cedar, in packing Astronomical and Surveying Instruments, Time-pieces, &c. By Thomas Gill, Esq.

Many years ago, the Editor was shown a surveying instrument by its maker, Mr. E. Troughton, F. R. S. which had been sent to a hot climate, and was returned to him that it might be put into order, as it was covered all over with a *viscid coat of varnish*, which had entirely prevented the motion of the sliding parts of it; in fact, it required to be taken to pieces, to have its coat of securing varnish removed, and to be again fresh varnished, to fit it for use.

These evils were occasioned by the employment of slips of *cedar* in the packing, as it is termed, of the instrument in its mahogany box; and would prove, as he said, a salutary lesson to him, against ever employing so mischievous an article in future.

This fact has been lately recalled to the Editor's notice, by another, and a somewhat similar circumstance. Mr. I. Lukens being about to return to the United States, and having had a marine chronometer made, required a packing case to enclose the mahogany box, containing it; he, however, stated that he should carefully avoid the use of one made of *pine*, as a *volatile varnish* was disengaged from it, which would *thicken the oil* applied to the movements of the chronometer!

Of course, equal care should also be taken to reject the *shavings of fir, pine, cedar*, and other similar woods, which are ordinarily employed in filling up vacancies within and around packages, or the same evil results will certainly be experienced; and it shows from what seemingly trifling causes, the very worst effects, in respect to the performance of these and other delicate instruments, may be often produced. [*Ib.*

Fire produced by the collision of copper, &c.

Although great care is taken to exclude from gunpowder manufactories all articles of iron, and to substitute copper and other metals which will not strike fire, in the metallic parts of the machinery, yet it is well known that explosions, attended with disastrous consequences, are very frequent. Excited by an occurrence of this nature, *M. Aubert*, Col. of artillery, was induced, in conjunction with Capt. *Tardy*, to resume some experiments which he had unsuccessfully tried, to ascertain, whether gunpowder would not explode by the shock of copper. The result of these renewals was, that powder would inflame by the stroke of copper upon copper, or upon the alloys of copper. This gave rise to further investigations, in presence of the committee of safety, and it was ascertained that gunpowder could be exploded by the stroke of *iron* upon *iron; iron* upon *copper; copper* upon *copper; iron* upon *marble;* and by using the balistic pendulum, by *lead* upon *lead;* and with suitable precautions even by *lead* upon *wood.* The experiments were successful both with English and French powder. The experiments most clearly show, that in all the manipulations of a powder manufactory, all violent shocks and percussions should be carefully avoided, since they may occasion the disengagement of sufficient heat to produce the inflammation of powder. [*Bul. D'Encouragement, Juin,* 1826.

Useful Alloy, resembling Silver.

M. Frick in melting together 50 parts of copper, 31.20 of zinc, and 18.75 of nickel, obtained a metallic alloy, white, not oxidable, very ductile, and which acquires a beautiful polish; in varying these proportions, viz. by taking 53.39 of copper, 29.13 of zinc, and 17.48 of inckel, he produced an alloy which has the sound and unchangeable nature of silver, but harder. It is particularly suitable for ornaments, objects of saddlery, boxes, watch chains, &c.. This alloy was sold at first at twelve francs per pound, but as nickel is sufficiently abundant in Germany, and as many artists are engaged in this composition, the price will necessarily fall. [*Idem.*

On the use of soapstone to diminish the friction of machinery: in a letter to the Editor of the American Journal of Science.

Boston, Aug. 6, 1827.

Dear Sir—My time and attention having been very much occupied with the duties of my profession, since I was at New Haven, I had almost forgotten your request, that I should communicate for your inspection, such facts as I could learn, relative to the use of steatite or soapstone, as a means of reducing the friction of machinery. I have observed in the July number of the *Franklin Journal,* a short article copied from the *Edinburgh Journal,* in which reference is made to this use of soapstone. The fact is simply stated, that "it facilitates the action of screws, and from its unctuosity, may be employed with much advantage, for diminishing the friction of the parts of machines, which are made of metal."

I understand that soapstone has been used for this purpose in the extensive manufactories at Lowell, for about two years, and with great profit and success. Besides answering the purpose to which it is applied, very much better than any other substance that can be procured, it saves a great deal of trouble and expense. It is first thoroughly pulverized, and then mixed with oil, tallow, lard, or tar, which ever may be the best adapted for the use for which it is designed. It is, of course, important to procure that which is free from *grit;* and it can be purified, in a good degree, by mixing the powder with oil, and diluting it, after it has stood a few minutes. The heavier particles will form a sediment to be rejected. It is used on all kinds of machinery, where it is necessary to apply any unctuous substance to diminish friction; and it is said to be an excellent substitute for the usual compositions applied to carriage wheels.

Some idea of the value of soapstone, in this use of it, may be formed from the following fact, communicated by D. Moody, Esq. the superintendent of the Tar Works on the Mill Dam, near this city. Connected with the rolling machine of that establishment, there is a horizontal balance wheel, weighing *fourteen tons*, which runs on a step of five inches diameter, and makes from seventy-five to a hundred and twenty-five revolutions in a minute. About a hundred tons of iron are rolled in this machine in a month; yet the wheel has sometimes been used from three to five weeks, without inconvenience, before the soapstone has been renewed. The superintendent thinks, however, that it ought to be more frequently applied.

This use of soapstone was discovered at Lowell, by an accident, the circumstances of which it is not necessary now to repeat. It is sufficient to say, that it is regarded by those who have used it, as an invaluable discovery. I have been assured that it has never been known to fail of producing the desired result, when applied to machinery which had begun to be heated, even in those cases where nothing else could be found which would answer the purpose.

Very respectfully your friend, &c.

E. Bailey.

[*Silliman's Jour.*

Improved Distilling Apparatus. By M. Marllard Dumiste.

M. Payen, in the name of the committee of chemical arts, has made a report on this apparatus to the Society of Encouragement.

The still is designed for the easy and economical preparation of aromatic liqueurs for the table. It consists of an ordinary alembic containing its wash, (bain marie) and communicating by the beck, or curved part of its head, with the upper extremity of a cylinder, which is divided into many receptacles by conic partitions.

The first of these receptacles is closed at its lower end by a cock; the second, immediately under it, the bottom of which is perforated with holes like a colander, is furnished with a filterer, composed of two woollen discs, between which a sheet of paper is introduced. This kind of filterer is placed over four other filterers, or receptacles of a similar kind, and finally the lower part serves as a recipient, to the bottom of which a cock is adapted, for drawing off the produce.

When it is desired to prepare an aromatic and sweetened liquor, by this process of distillation, the spices and alcohol diluted with water are placed in the wash; a proper quantity of sugar is then dissolved, and the sirop is poured into the upper receptacle of the cylinder. The distillation is performed with the customary precautions, and as soon as the necessary proportion of spirituous liquid has passed into the cylinder, which may be observed by a candle placed at a proper height, the whole of the mixture of sirop and aromatic alcohol is let out into the filterers.

This mixture, in passing successively through the five filterers, becomes completely limpid, and the prepared liquor, without being decanted, may be drawn out of the recipient fit for use.

[*Bul. des Sciences.*

On the Laws which Govern the Power of Steam.

The following laws of steam were announced by M. Morin, in an interesting course of Lectures at Geneva, attended by philosophers as well as artists.

First Law.—Whatever may be the temperature and pressure under which the steam is produced, the same quantity of heat must be employed to produce the same weight of steam; and as the quantity of heat developed is proportioned to the quantity of fuel, it is obvious that a given weight of steam, a kilograme, for example, will always cost the same price, whether it be produced at a low or a high pressure. This important discovery is due to M. Clements, and is one of the finest results of his numerous investigations.

Second Law.—The volume of the same quantity of steam, is in inverse proportion to the pressure to which it is subjected. This law, discovered by Mariotte, is applicable to all gases. Steam acts, in many respects, as a permanent gas.

Third Law.—The dilatation of steam is $\frac{1}{267}$ of its volume at zero, for each degree of the centigrade thermometer. We are indebted for this law to the remarks of Gay Lussac and Dalton.

Fourth Law.—The latter gives the elastic force of steam, according to the degree of heat at which it is produced. The following table exhibits this law, which can be expressed only by numbers.

Pressure.	Centigrade.	Difference.
1 Atmos.	100°	—
2	122	22
3	135	13
4	145	10
5	153	8
6	160	7
7	166	6
&c.	&c.	&c.

Idem. Feb. 1827.

Dutch method of extracting Blue Colour from Woad.

The leaves are put together with water into a cask, and the mass loaded with weights. In this state they are suffered to remain for sixteen or eighteen hours, or until the saturation is complete, which is indicated by the water assuming a yellowish green tinge. The leaves are then taken out, and the solution suffered to remain a few minutes, in order to precipitate its earthy particles; it is then filtered through a sieve of iron wire, horse hair, woollen, or silk, and afterwards stirred violently for a quarter of an hour, with a wooden spatula.

At this stage of the process, a quantity of lime water is poured into the extract, and the stirring is continued for some minutes longer, after which it is suffered to repose for several hours. At length a beautiful blue sediment will become deposited at the bottom of the vessel, and nothing further is requisite than to filter, and afterwards dry it in small heaps upon a wooden table, by the rays of the sun, in order to bring it to a marketable state. [*Bul. des Sciences.*

A mode of Preparing Paper which shall resist Moisture.

By M. Engel.

This process consists in plunging unsized paper once or twice into a clear solution of mastic in oil of turpentine, and drying it afterwards by a gentle heat. The paper thus prepared, without becoming transparent, has all the properties of writing paper, and may be used for that purpose. It is particularly recommended for passports, for the books of porters, and other labourers, and indeed is desirable for a great variety of purposes for which paper that is capable of absorbing damp, is very inconvenient. When laid by, it is perfectly secure from being injured by mouldiness or mildew, and is not likely to be destroyed by mice or insects.

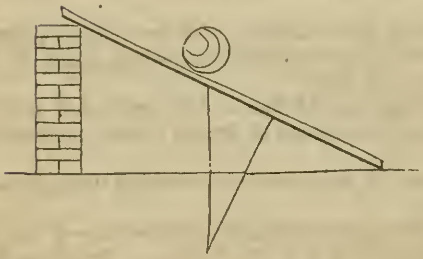
The inventor states, that a solution of caoutchouc, would produce a still better effect, but he does not say in what way that elastic gum is to be dissolved or diluted for use, or dried afterwards. This mastic paper has been used by printers, who have discovered in it the above mentioned qualities. By adding a little verdigris to the solution, the paper may be made to assume a greenish tint, similar to the paper known in Paris under the name of "*Papier de Cassabon.*" [*Bulletin des Sciences, &c.*

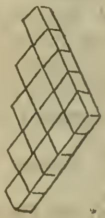
New Invented Apparatus for Expeditiously Drying Mildewed Grain.

This apparatus consists of two long concentric metal pipes, or tubes, winding in a spiral direction. The smaller pipe which is in the centre of the large pipe, forms a passage for the heated air, and the larger pipe receives the corn for drying, by means of a hopper attached to its upper end. The spiral shape of the larger, or conducting pipe, converts it into a long, inclined plane, in descending which, the grain is sufficiently heated to render it perfectly dry before it is discharged at bottom. [*Annal mens de l'Industrie.*

On Diagrams, and other outlines in Brass rule.

In our notice of Hales' Introduction to Carpentry, p. 212, we mentioned that the cuts in it, of which there are a considerable number, were all made of brass rule, by Mr. L. T. Jackson, of Brunswick, Maine; of these he has sent on three specimens, which we insert. They are much less complex than several of those in Mr. Hales' work, and are the first which were made.





The inventor has taken the preliminary steps, in order to obtain a patent, as they are likely to supersede wood cuts, where outlines are required, being made with greater facility, and less liable to injury. The section of the union in which the inventor lives, is one in which there is but little demand for such work, and we have no doubt that he would give the necessary instructions, and dispose of the right to use it, on very liberal terms.

French patents granted in the fourth quarter of 1826.

P. E. Kinkelin, Paris, for a system of inland navigation, upon an uninterrupted anchorage—15 years.

N. H. Maniclor, London, for the preparation called *vaxeme*, for making wax lights—15 years.

D. Rodier, Nimes, for a method of producing all kinds of figures on silks, wool, cottons, &c.—15 years.

J. Nicholson, Lille, for a new method of working bobbins, tubes, and other instruments, used in the preparation and spinning or twisting of all fibrous substances—15 years.

J. Walker, Paris, for making braces, girdles, and elastic garters, with double covered springs—15 years.

J. C. Dietz, Paris, for a steam engine and water pump, with metallic and elastic pistons, adapted to be used instead of horses, and to serve to propel vessels ascending canals and rivers, and applicable to the draining of marshes—5 years.

T. Dobree, Nantes, for the fabrication of felt for sheathing vessels —15 years.

Werdet, the father, and Miss M. E. Werdet, Paris, for a method of writing straight without lines—5 years.

M. Battendier, Paris, for an expanding leather trunk—5 years.

A. F. Berolla, Paris, for a pendulum, consisting of a figure which swings backwards and forwards, instead of from left to right—5 years.

J. A. Bart, and E. Dorleans, Paris, for an improvement in making optical glasses—10 years.

N. Charoy, Paris, for a machine called the spinner's guide, adapted to the mule jenneys—5 years.

J. B. B. Laignel, Lyon, for a system of navigation on rapid rivers —15 years.

J. P. Lelyon, Versailles, for a carbine, with four charges, having only one barrel, and which may be used as a fowling piece, by employing a different barrel—5 years.

J. Zuber & Co. Rixheim, near Mulhouse, for a method of printing with engraved hollow rollers, instead of by the present method—10 years.

J. B. Godart, Amiens, for a machine for combing wool, &c.—15 years.

J. Neale, Cernay, for a double pressure steam-engine—5 years.

C. Frederic, and his wife, Mrs. J. M. Gagnoux, Grenoble, for a loom for making nets with fixed square meshes—15 years.

A. Galy-Cazalat, and Capt. Dubain, for an impelling power, without machinery, to be used instead of steam in merchant vessels, and for its application to a fire-ship, which will not sink—10 years.

Mr. Cæssier, Paris, for improvements in Panly's guns, having piston and *bascule*—5 years.

A. J. Lille Froment, and Mrs. L. B. Beaugnon, his wife, Paris, for a compound mastich, for taking impressions of oil and water colour paintings, on linen, paper, wood, metals, and stone; also, for a new process of copper plate printing, and for gilding, or washing with silver, without using mercury or fire; and for a machine for printing large pictures—10 years.

B. J. Dubost, Lyon, for a combination of steam engines, and the use of horses, in towing craft up rivers, &c.—15 years.

J. B. Wilks, London, for improvements in the evaporation of water for steam engines, and other uses—15 years.

J. H. Pape, Paris, for an improved piano, with a cast sounding board, and a new disposition of the hammers—10 years.

L. Roth, Sceaux-Penthievre, for a system of distilling in a vacuum, with or without fuel.

J. Cristofle, Paris, for a new method of making horn, or ergot buttons—5 years.

Chevandier, Paris, for a furnace in which small coal may be used, for drying wood, for the use of glass founders—5 years.

P. Joarhit, St. Etienne, for an apparatus for taking off the gloss from cloths, &c. by steam—5 years.

Miss F. P. Fournier, Paris, for improvements in children's whalebone pads and rollers—5 years.

P. N. Tastemain, Senouches, for a reaping machine—15 years.

A. Malbec, Paris, for a method of preparing the extract of milk, or milk for travelling—5 years.

H. P. Coiffier, Lyon, for a gilt alphabet of different materials and dimensions, for sign-boards, either on wood or glass, instead of the usual method of painting—10 years.

M. Middendorp, Paris, for an improved printing machine—5 years.

P. A. M. Chausonnet, Paris, for a method of making metal buttons in imitation of silk—5 years.

Gregoire, senr. and H. L. Gregoire, junr., Nimes, for a process and machine adapted to the machinery of jacquard, for making figured tulle and blond-lace.

V. L. F. Simonard, Lyon, for a machine for ascending rivers by the effect of the current—15 years.

LIST OF PATENTS FOR NEW INVENTIONS,

Which have passed the Great Seal from March 27, *to May* 19*th*, 1827.

To Aristides Franklin Mornay, of Ashburton House, Putney Heath, in the County of Surrey, Esq. who, in consequence of a communication made to him by a foreigner residing abroad, and of discoveries by himself, is in possession of certain improvements in preparing for smelting, and in smelting, ores and other substances, containing certain metals; or in extracting such metals from such ores and substances. Dated March 27, 1827.

To Matthew Bush, of Dalnonach Print Field, near Bonhill, near Dunbarton, North Britain, calico-printer; for certain improvements in machinery, or apparatus for printing calico, and other fabrics. Dated March 27, 1827.

To Bennett Wodcroft, of Manchester, in the county of Lancaster, manufacturer; for certain processes and apparatus for printing and preparing for manufacture, yarns of linen, cotton, silk, woollen, or any other fibrous materials. Dated March 31, 1827.

To Henry Aspray Stothert, of the city of Bath, founder; for certain improvements on, or additions to ploughs. Dated April 4, 1827.

To John Paterson Reid, merchant and manufacturer, in Glasgow; for an improvement or improvements on power-looms, for weaving cloth of various kinds. Dated April 4, 1827.

To Joseph Tilt, of Prospect-place, in the parish of St. George, Southwark, in the county of Surrey, merchant; who, in consequence of a communication made to him by a person residing abroad, is in possession of certain improvements in the boilers used for making salt, commonly called salt pans, and in the mode of applying heat to the brine. Dated April 4, 1827.

To Edward Cowper, of Clapham-road-place, gentleman; for certain improvements in printing music. Dated April 5, 1827.

To James Shudi Broadwood, of Great Pulteney-street, Golden-square, piano-forte maker; for certain improvements in Grand Piano-fortes. Dated April 9, 1827.

To James Whitaker, of Wardle; for certain improvements in Machines, or Machinery, for pressing Cardings from Woollen or other Carding Engines, and for drawing, shibbing, and spinning Wool and Cotton. Dated April 24, 1827.

To Carlo-Glugo, of Lyons, in France, but now residing in Fenchurch-street, in the city of London, loom-manufacturer; for certain improvements in Weaving Machinery. Dated April 24, 1827.

To Morton William Lawrence, sugar-refiner; for improvements in the process of refining Sugar. Dated April 28, 1827.

To Joseph Anthony Borrollas, of Surrey, watchmaker; for a detached Alarum Watch. Dated April 28, 1827.

To Robert Daws, upholsterer; for certain improvements on Chairs, or Machines, calculated to increase ease and comfort. Dated April 28, 1827.

To Thomas Breidenback, of Birmingham, in the county of Warwick, merchant; for improvements in certain parts of Bedsteads. Dated April 28, 1827.

To Benjamin Somers, M.D.; for certain improvements on Furnaces for smelting different kinds of metals, ores, and slaggs. Dated April 28, 1827.

To William Lockyer, brush-maker; for an improvement in the manufacture of a material or materials, and the application thereof to the manufacture of Brushes, and other purposes. Dated April 28, 1827.

To Henry Knight, clock-maker; for a Machine, Apparatus, or Method, for ascertaining the attendance to duty of any watchman, workman, or other person; which machine, apparatus, or method, is also applicable to other purposes. Dated April 28, 1827.

To John M'Curdy, of Cecil-street, Strand, in the county of Middlesex, Esquire, who, in consequence of a communication made to him by a certain foreigner, residing abroad, and discoveries made by himself, is in possession of an invention of certain improvements in the process of rectification of Spirits. Dated April 28, 1827.

To John Brown and William Dudderidge Champion; for a certain composition or substance, which may be manufactured or moulded into bricks, or into blocks of any form, for building; and also be manufactured and moulded into, and made applicable for all internal and external ornamental architectural purposes, and for various other purposes. Dated May 5, 1826.

To David Bentley, bleacher; for an improved Carriage Wheel. Dated May 8, 1827.

To Thomas Patrick Coggin, of Wadworth, near Doncaster, machine maker; for a new or improved machine for dibbling Grain of every description. Dated May 19, 1827.

NOTICES.

To Correspondents.—We have read "A Practical Mechanic" with much care, and are at a loss to perceive how his condenser is to operate. If he will supply us with a sketch, which will enable us to understand his propositions a little better in detail, they shall receive that attention which they may appear to merit.

The promise to which "A Mechanic" alludes, has not been forgotten, and will soon be fulfilled. We have waited for some promised details which are much needed.

A subscriber has suggested that the natural and economical history of the cotton plant, one of the most valuable staples of our country, would be very interesting. We will prepare a paper on this subject, and shall be obliged by the communication of any facts, which may aid us in the work.

The paper on the Mechanical Powers has been received,—it will be reserved until we obtain some cuts for "The Artisan," when it will appear, and the subject be pursued.

Mechanics' Institutes.—The editor of the London Mechanics' Magazine, is preparing a general history of Mechanics' Institutes, and is desirous of obtaining such information, general and particular, respecting those in the United States, as will enable him to notice them according to their merits; we wish to aid him, in his laudable undertaking, and shall be obliged by communications from officers, or others, attached to such establishments, containing a concise history of their rise, progress, objects; and success. By Mechanics' Institutes, we mean all those associations which have been formed for the diffusion of useful knowledge, among manufacturers and mechanics, by whatever name they may be known.

The Franklin Institute, is about to commence those active operations which pertain to the season of the year. The opening lecture will be delivered by the professor of Mechanics, on Tuesday, the 6th inst. Dr. Bache's Introductory on Thursday, the 8th, and the lectures on Mechanics and Natural Philosophy, will be continued every succeeding Tuesday; and those on chemistry, and its application to the arts, every Thursday. Tickets for ladies, admitting to all the lectures, may be obtained at $2 each, on application to the Treasurer: Mr. S. V. Merrick, back of St. James's Church, North Seventh Street.

THE

FRANKLIN JOURNAL,

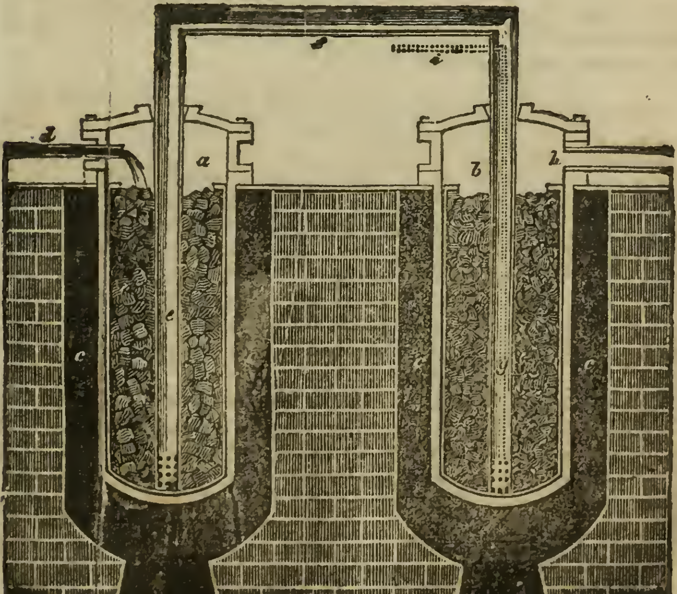
AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

DECEMBER, 1827.

A Description of various apparatus employed in the preparation of Gas, for the purpose of illumination, for which patents have been obtained in England.



Description of Taylor's *Patent Gas Apparatus.*

We have procured cuts of a variety of apparatus recently patented in England, and purporting to be improvements in the mode of preparing, or supplying, gas, for the purpose of illumination. As experience has demonstrated that gas lights may be advantageously substituted for the former methods of obtaining artificial light in a greater number of cases, and particularly in cities, and in many extensive manufactories, the subject has become one of high interest. New York and Baltimore already enjoy the benefits of this improvement; and we apprehend that Philadelphia will not long lag in the rear, that hyper-prudence, which is thought to be one of her characteristics, to the contrary notwithstanding.

We shall continue to furnish an account of all the improvements made in the gas works in England, or elsewhere; as we may thereby aid in preventing that wasteful expenditure in other places, which marked the establishment, and early progress, of the Baltimore works. It is high time for us to dismiss that vanity which has, in many instances, more than doubled the cost of public undertakings, the vanity of making them American, and which has commonly ended in our being compelled to adopt the modes which the experience of other countries had proved to be best; a procedure which a little sober good sense would have suggested in the first instance.

We shall hereafter give a concise history of the origin and progress of gas illumination, and also some account of the instruments in use previously to those now presented; in doing this, we shall be as brief as possible, without sacrificing perspicuity. In the present instance, we merely give the direct description of the articles represented, with such remarks, only, as are required to explain them clearly; this, we have no doubt, will be universally preferred to the extended specifications furnished by the patentees, and which would cover too many of our pages. With respect to the merit of either of the plans proposed, excepting where we have been informed of the results from actual experience, our readers must not always look to us for an opinion; although, we shall freely present whatever views may appear to us pertinent.

On the first page of this number, we have given a section of Taylor's Gas apparatus, which is adapted for the distillation of liquid substances only, or such as may be rendered liquid by being heated previously to their introduction.

When the liquid matter introduced into the retorts is of easy decomposition, one distillation of it, through a single retort, will, in general, be sufficient to separate the gas in a tolerably pure state. When, however, they are such as require a longer process, the gaseous products of the first distillation are passed into a second retort, to complete the separation of the contaminating matter. As many as ten retorts, similar to those shown in the engraving, may be conveniently arranged over one furnace. In the case of a single distillation, it is, therefore, to be understood that these are all supplied at once with the fluid matter, and the product of each respective retort, is carried from it directly to the gas-holder: but when a second distillation is necessary, the ten retorts before mentioned would be employed as five pair; and the diagram is drawn so as to show the operation either by a single, or by a pair of retorts, which we shall now explain.

The figure gives a vertical section of two cast iron retorts, *a* and *b*, fixed over a furnace constructed with fire bricks; their length may be estimated at about four feet; their form is cylindrical, with covers accurately fitting their necks, so as to render the vessels air tight when they are luted on, and fastened down by keys or screws. They are placed or suspended erect in the brick work, by resting on their projecting flanches, leaving open spaces around them, as at *c c c c*, by which very extended surfaces are exposed to the immediate action of the fire.

Within each of the retorts, a casing or shell of wrought iron is placed exactly fitting the interior; these are filled with fragments of bricks, stones, coke, metal, or any substance that will bear a red heat without fusing; and as these materials frequently require shifting, each case is provided with ears, rings, or lugs, for the convenience of drawing them out of, or letting them down into, the cast iron retorts. Vertical tubes, *e g*, are placed in the centre of each retort; these are connected at their upper ends by the horizontal tube *f*, and passing through the covers, their other ends descend to the bottoms of the retorts, where they are perforated with holes, as shown in the figure. The internal cases, previously empty, are then filled with the broken bricks, and various substances, as before mentioned, and the covers and joints being all properly luted and secured, the retorts are exposed to the action of the fire until the materials acquire a red heat. Thus prepared for the operation, the fluid to be distilled is allowed to flow through the pipe *d*, in small quantity, into the retort *a;* here, falling upon the red hot materials, the process of decomposition commences, which is assisted by the filtration of the liquid through these substances. Having arrived at the bottom, the gaseous portion passing through the perforations, rises up the tube *e*, from thence proceeding along the branch *f*, it descends into the second retort *b*, by the pipe *g*, and passing out again through the holes at the bottom of *g*, the gas re-ascends among the ignited materials, being purified in its progress, until it arrives at the tube *h*, which conducts it to the gas holder.

When the whole operation consists in a single distillation in one retort, the fluid is introduced by means of a pipe *i*, shown by the dotted lines. In this case the tube *g*, does not extend higher than the cap of the retort, in the centre of which the pipe enters, and passes down the middle of the tube *g*, to within six inches of the bottom; from thence, the liquid, flowing through the perforations among the red hot materials, becomes quickly decomposed, and the resulting gas, filtering as it ascends, reaches, in nearly a pure state, the tube *h*, which conducts it, as in the former case, to the gas holder.

It will be noticed, that the substances in the second retort are in larger fragments than those in the first, which is an arrangement found to be advantageous, and therefore recommended by the patentee in his specification. In operating by single distillation the largest fragments are to be thrown into the retort first, with the smaller on the top, which is a disposition similar, in effect, to the former.

Cast-iron is not considered by the patentee as the essential material for the construction of the retorts; they may be made of fire clay, and various other substances; but a preference is given to cast-iron as the most economical and convenient. There is, likewise, no particular material specified for the production of gas, the apparatus being considered alike applicable to the distillation of *all* fluid matters from which carburetted hydrogen may be obtained.

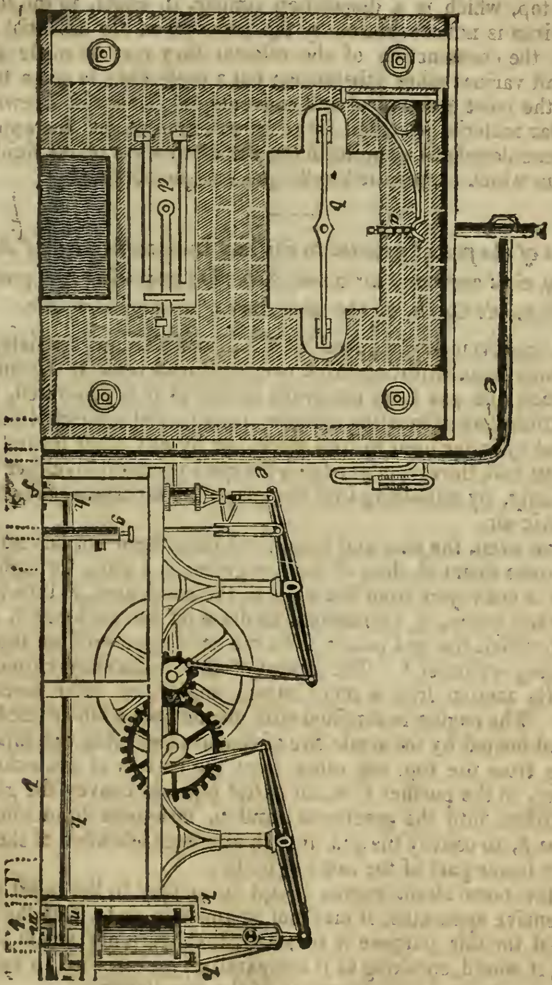
Account of the patent granted to SIMEON BROADMEADOW, *of Abergavenny, civil engineer, for a new method of preparing and purifying Inflammable Gases, by the admixture of Atmospheric Air.*

THE improvement proposed by Mr. Broadmeadow, consists, in the first place, in substituting brick ovens for iron retorts; secondly, in exhausting the gas from the ovens as fast as it is generated, by the application of an exhausting cylinder, constructed somewhat similar to the blast cylinder used in iron works, or by any other means of exhaustion; and, thirdly, in purifying the gas so generated, either wholly or partially, by admitting into the gasometer a certain portion of atmospheric air.

a is an oven, the size and number of these need not be restricted; *b*, the oven door; *d*, door of the fire-grate; *e*, a pipe, through which the gas is conveyed from the oven to the condenser, *f*, into which a small hand pump, *g*, is inserted, to draw off the coal-tar; *h*, a pipe, through which the gas passes from the condenser into the top of the exhausting cylinder *i*. The piston of this exhausting cylinder receives its motion from a small steam engine, or other mechanical power. The engine is supplied with steam from a boiler fixed in the flue, and heated by the waste fire of the furnace. *k k*, two pipes; one leading from the top, the other from the bottom of the exhausting cylinder, to the purifier *l*; *m*, an outlet pipe, to convey the gas from the purifier, into the gasometer; and *n*, is a pipe branching from the pipe *h*, to convey the gas, at each alternate vibration of the beam, into the lower part of the same cylinder.

As the term *steam engine* is apt to convey to the mind an idea of expensive apparatus, it may not be amiss to state, that the engine required for this purpose is so small, that were not steam the first mover, it would, speaking of it comparatively, even with an engine of one-horse power, be ill-deserving of the appellation.

In the erection of works, on the ordinary plan, one of the principal items of charge, is that for iron retorts, together with the hydraulic main, and other necessary connexions; and in conducting works thus constructed, an enormous expense is annually incurred, from the oxidizing or burning away of the retorts. Indeed, the oxidation of the retorts is so rapid, that, however the time of their duration may vary, from a difference in the quality of iron, or mode of constructing the furnace, they cannot withstand, on an average, more than eight or nine months' exposure to the fire.



BROADMEADOW'S *Apparatus for preparing and purifying Inflammable Gas.*

In the patent process no retorts are used, but ovens constructed of brick, or other suitable materials; the cost of first erection, and the subsequent annual charge for wear and tear, is greatly diminished. The ovens are also subject to wear, and to require repairing; but the expenses thus incurred, are, comparatively speaking, too trivial to deserve mention. At works erected on this principle at Abergavenny, an oven, which has for the last two years been in constant use, is apparently uninjured; a less sum than twenty shillings each, per annum, is found sufficient to keep them in repair.

As each of these ovens contains a charge equal to about six full-sized iron retorts, and requires to be charged but once in twenty-four hours, there is not only a saving in the cost of first erection, and in the annual expenditure, but also in the labour usually expended in the drawing of the charges, and in re-charging.

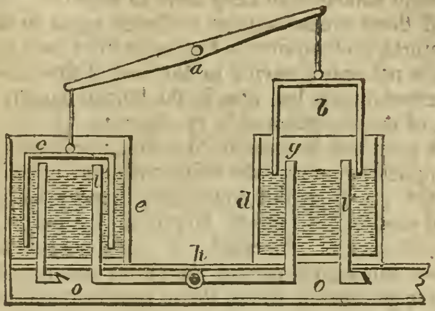
One of the principal features in Mr. Broadmeadow's invention, is, that of his application of an exhausting cylinder, or other apparatus, to exhaust the gas from the condenser, thereby causing a partial vacuum, and enabling the gas to flow from the ovens into the condenser, as fast as it is generated. A portion of atmospheric air, equal to about one-eighth part of the entire quantity of gas, is admitted into the gasometer, where the oxygen of the atmosphere, mixing with the sulphuretted hydrogen, precipitates the sulphur, and gives to the gas, when lighted, a greater degree of brilliancy. This mode of purifying is said to be so efficient, that when the coal used is of good quality, no other purifying process is required. As the admission of too great a portion of atmospheric air would prove injurious, the requisite speed at which the exhauster should be worked, is shown by a water-guage.

The advantages to be derived from the adoption of this patent process are considered by the patentee to be as follow:—first, the cost of erecting works on this principle, is calculated at one-third less than on any other; second, the annual expenditure for retorts is entirely obviated; third, the gas is improved, and much more effectually purified; fourth, the coke, from the coal being carbonized in larger quantities, is of a superior quality.

Description of the apparatus for exhausting, condensing, or propelling Air, Smoke, Gas, or other Aeriform products, for which a patent has been obtained by SIMEON BROADMEADOW, *the inventor of the ovens described in the foregoing article.*

THIS invention consists in the application of some very simple machinery for the purpose of exhausting or withdrawing air, smoke, gas, and other aeriform products, generated in the process of distillation, and by thus removing the pressure, producing a draught or current of atmospheric air through the fire-place, for the combustion of the fuel, and from thence up the chimney; also, in afterwards propelling the aeriform fluids withdrawn, so as to blow the fire of the furnace, or in otherwise disposing of it through flues or channels, as may be found desirable.

There are three forms of apparatus described in the specification, but the patentee states that he does not confine his claim to these particular arrangements, but includes every mode of applying the principle of exhaustion caused by raising a vessel inverted in water or other suitable liquid.* The first of these three forms is shown in the annexed diagram.



In the above figure, (which is a vertical section) *a* is the fulcrum of a lever or beam, with two inverted vessels, *b* and *c*, suspended to its extremities; these vessels are open underneath, but air-tight above: *d* and *e* are two larger vessels, filled with water to the same level, into which *b* and *c* respectively ascend and descend: *g h i* is a tube, or pipe, which passes through the vessels *d* and *e*, and reaches above the surface of the water; at the extremities are two valves, which respectively open outwards into the inverted vessels, with a pipe at *h* connected to the flue or furnace, where the exhaustion is to be effected. *k* and *l* are separate pipes, passing through the bottom of *d* and *e*, and extending a little above the surface of the water; they are open at top, and have valves at the bottom, opening into the trunk *o o*, for carrying off the gas, or smoke.

An alternating motion being imparted to the beam, by a steam engine, or other first mover, the air, smoke, or gas, passes up the tubes *g h i*, and fills each inverted vessel, as *b* and *c* are successively drawn up out of the water; the descent of the inverted vessels closes the valves at *g* and *i*, and opens those at the bottom of the tubes *k* and *l*, through which the gas or smoke is driven forward into the trunk *o o*, and thus, by the reciprocation of the beam, a continual blast, or stream of gas is produced in the trunk *o o*, to be applied as circumstances may require.

The subjoined figure represents another arrangement of the apparatus for situations where a motive engine cannot be applied, and where it is desired that the operation may be conducted slowly and regularly.

In this case, the inverted vessel is suspended by a chain, or rope, passing over a pulley, with a weight at the other extremity, sufficient to raise the inverted vessel, and thus perform the operation of ex-

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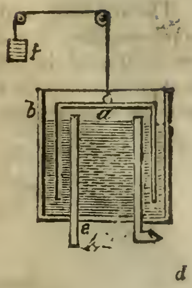
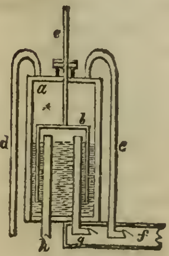
* In claiming so much, we think the patentee has been badly advised, as blowing machines and pumps have long since been made on similar principles. [*Editor of the Register of the Arts.*



haustion. *a* is the inverted vessel, *b* the tank, filled with water, as shown; *d* is the outlet pipe, having a valve opening outwards at the bottom. *e* is the inlet pipe, having a valve opening at top into the inverted vessel. When the inverted vessel is full of air, gas, or other elastic fluid, the weight *f* must be diminished, when the vessel, by its own weight, will propel the air contained therein, through the tube *d*, and, opening the valve at bottom, it will be driven forward in a current, to the point desired.



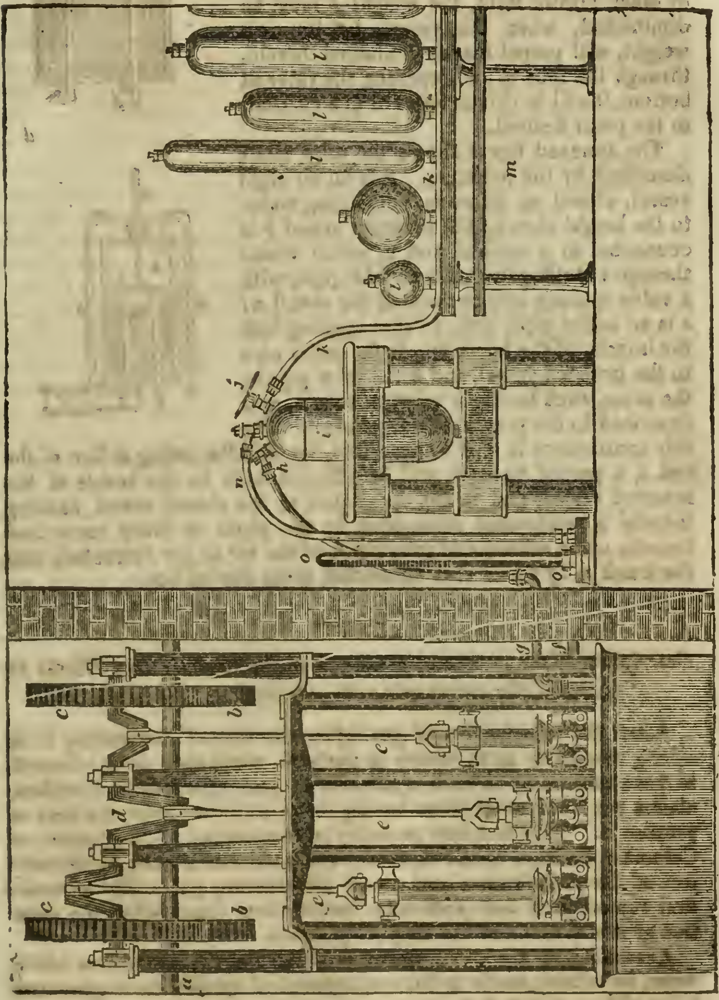
The annexed figure shows the third mode described by the patentee. *a* is an air-tight vessel, closed on all sides, containing water to the height shown; the inverted vessel *b* is connected to a vertical rod *c*, which works through a stuffing box: *d* is an inlet pipe, with a valve opening into or towards the vessel *a*: *e* is an outlet pipe, with a valve opening into the interior of the trunk *f*: *g* is the outlet pipe to the inverted vessel, and *h* the inlet pipe to the same, each having a valve as shown, and described in the previous arrangements. By this contrivance it will be seen that, by the alternating action of the rod *c*, a partial vacuum will be effected, both in the inside of the inverted vessel, and in the upper part of the closed vessel, causing thereby a continuous exhaustion in the pipes or tubes connected thereto, and a subsequent propulsion of the air or gas extracted, into the trunk *f*, by which it is conducted to its destination.

Description of the apparatus employed at the Portable Gas Works in London, for compressing the gas into portable lamps.

After the introduction of gas-lights, the idea of condensing it in strong vessels so as to render it portable, must soon have occurred to those habituated to think upon such subjects; the Editor, therefore, claims but little merit from having been, as he believes, the first to propose it. This fact may probably be recollected by Dr. Cooper, of Columbia College, South Carolina, who published a work on the subject of the manufacture and use of illuminating gas. The proposition was made to that gentleman, two or three years before any mention of it was made in the English journals.

According to the most recent intelligence, the objections which were, for a time, made to the employment of the condensed gas, have been either obviated by improvements in the apparatus, or have proved to be groundless, and the business of the company who carry on the works, is said to be greatly extending.

The drawing and description of the apparatus now used for the condensation, are furnished by L. Hebert, Esq. Engineer, who is the Editor of the "Register of the Arts," &c.; he has, in the drawing, brought some parts nearer together than they are in the works, in order to show the principal operations, at one view.



In the *Portable* Gas-works, as in all others, the gas as it is generated and purified, is conducted to, and kept in, those large vessels called gasometers, or rather gas-holders; so far the operations in gas-works do not materially differ, but here the similarity ends; for the gas, instead of being distributed from thence, through pipes, in its natural volume, under simple atmospheric pressure, is conducted from the gas-holder to the chambers of a set of force pumps, by which it is gradually compressed into a thirtieth part of its previous bulk. The manner of effecting this we will now explain.

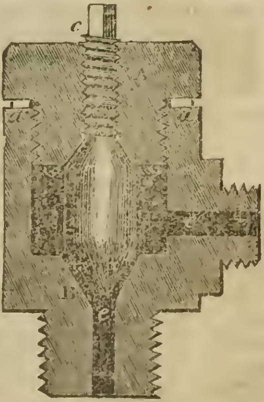
a, is the main horizontal shaft of a steam engine, upon which are fixed two spur wheels *b b;* the teeth of these take into the teeth of two similar wheels, *c c*, fixed on the axis of another shaft, carrying three cranks, to which a rotary motion is thereby communicated. The cranks give an alternating motion to the three rods *e e e*, which work three force pumps. Of the construction of these pumps, we shall presently give a description. As the plunger of each pump is successively raised, a quantity of gas, equal to the space previously occupied by it, flows from the gas-holder into the chamber, at the opposite end, by means of a pipe of communication, part of which is brought into view at *f*. The valve by which the gas enters, opens *inward*, so that it cannot return the way it came; but there is another valve which opens *outward*, and this is kept closed by a spring of sufficient power to prevent the escape of the gas in the uncompressed state; upon the descent of the plunger, the strength of this spring is overcome, the gas is forced out, and the valve again closes. From the pumps, the gas proceeds along the tube *g*, and enters by the jointed valve *h* into a strong wrought-iron recipient, *i;* in this vessel it is evident the gas might be collected and condensed to any required number of atmospheres; but the valve *j* being opened (by the cross-handled key shown) it is suffered to flow through the pipe *k k*, which is extended along the upper side of the filling table *m*, and from thence into the reservoirs (portable lamps,) *l l l l l*; by which arrangement the pressure of the gas becomes equalized in all the vessels, however great their number. In this manner thirty or forty lamps are filled at a time; but as the limits of our diagram are necessarily contracted, and as a more extended view would be useless, only five lamps are shown: and these are drawn of various sizes and shapes, to show the various forms of these vessels.

In a Portable Gas establishment there are several of these *filling tables*, similar to the part of one shown at *m;* to each of them is fixed a conducting tube like that at *k k*, running the whole length; at regular distances along these tubes are perforations furnished with strong well-screwed nozzles, all of which fit easily, yet with the utmost precision, to the bottom valve of the lamps, in the manner shown in the drawing.

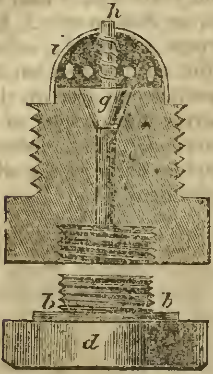
The pumps at work together, were six in number, and as every descent of the plungers compresses a quantity of gas uniformly into every lamp, they become gradually, yet rapidly, filled. The degree of condensation at which the gas has arrived by the continual action of the pumps, is accurately denoted, at all times, by means of a mercurial gauge, applied in the following manner. The pipe *n*, which proceeds from the recipient *i*, conveys the gas under compression into the reservoir of mercury at the bottom of the gauge *o o;* the pressure of the gas upon the surface of the mercury, causes the latter to rise in a long glass tube, which has an accurately graduated scale affixed to it, showing clearly the degree of pressure, or condensation, in the lamps. When the mercury arrives at the line denoting 30 atmospheres, the valve *j* is shut by means of the cross handle. All the lamps attached to the pipe in connexion with the closed valve, being now filled, are taken away, by unscrewing them from the sockets in the tube. The lower valves of the lamps close by the pressure of the gas within them, and the contents are further secured from escaping, by screwing a cap over these lower valves. To ascertain whether there is any leakage, the lamps are now taken by another workman, and immersed in a trough of water, where, if any exists, it is immediately shown by the bubbling up of the gas. The lamps are taken out to their destination by the company's carts, which are regularly despatched to all parts of the town.

The tube *g*, which conducts the gas from the pump-house to the recipient, *i*, is immersed in water by passing through a trough filled with that fluid, by which, if any leakage should take place in this supply pipe, it may be immediately detected. Instead of only one mercurial gauge, there are usually three employed together; each of these have a communication with the vessel *i*, so that if the action of one of them should prove defective, it is immediately discovered by its disagreement with the others.

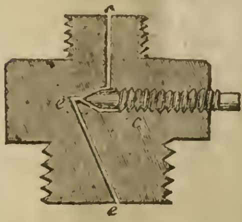
It now becomes necessary to describe the *construction* of the valves. They are of three distinct kinds, having each their peculiar and separate uses, and were the subject of a patent lately granted to the inventor, Mr. David Gordon.



The annexed engraving gives a sectional view of an improved stop valve, similar to those shown in the condensing apparatus, attached to the principal recipient, *i;* this is especially adapted for transferring the compressed gas from one vessel to another, without occasioning loss during the process. It is composed of two pieces of metal, A and B, which are screwed together with a soft metal collar between them, at *a a; e e* represent the openings through which the gas is allowed to pass. The piece A has the regulating steel screw *c* tapped through it, being formed at the lower part with a double cone, one part of which cone is adapted to fit correctly into the cavity in the under side of the piece A. Now when the lower cone of the regulating steel screw is screwed or forced tight down into the conical seat in the piece B. it prevents all escape of the gas; and when it is desired to transfer compressed gas from one lamp, or reservoir, to another, the regulating screw *c*, is to be turned until its upper cone fits and applies correctly into the conical cavity in the piece A, and thereby prevents all escape of the gas up the threads of the regulating screw during the process of transferring, allowing at the same time free passage of the gas from one reservoir to another through the openings *e e*.



This figure is a sectional representation of the improved valve, which is fixed at the bottom of each reservoir or lamp, for the purpose of filling them in the manner before described. This filling valve consists of a small conical plug, *g*, which is fitted into a conical cavity or seat in the piece of metal, *c*, similar to the valves of an air gun, being closed by a slight steel spring *h*, and guided in its way by a metal pin, which slides through a hole in a small brass cap or perforated cover, *i*, represented as screwed over it; *d* shows a brass plug, which is intended to be screwed into the lower aperture of the piece *c*, after the filling is completed. The upper surface of this screw plug, is furnished with a soft metal ring or collar, *b b* (as in the before mentioned valve,) which being pressed by the force of the screw into close contact with the under side of the piece *c*, effectually prevents any escape of the gas from that end of the reservoir, even if the filling valve, *g*, should not be quite air-tight.



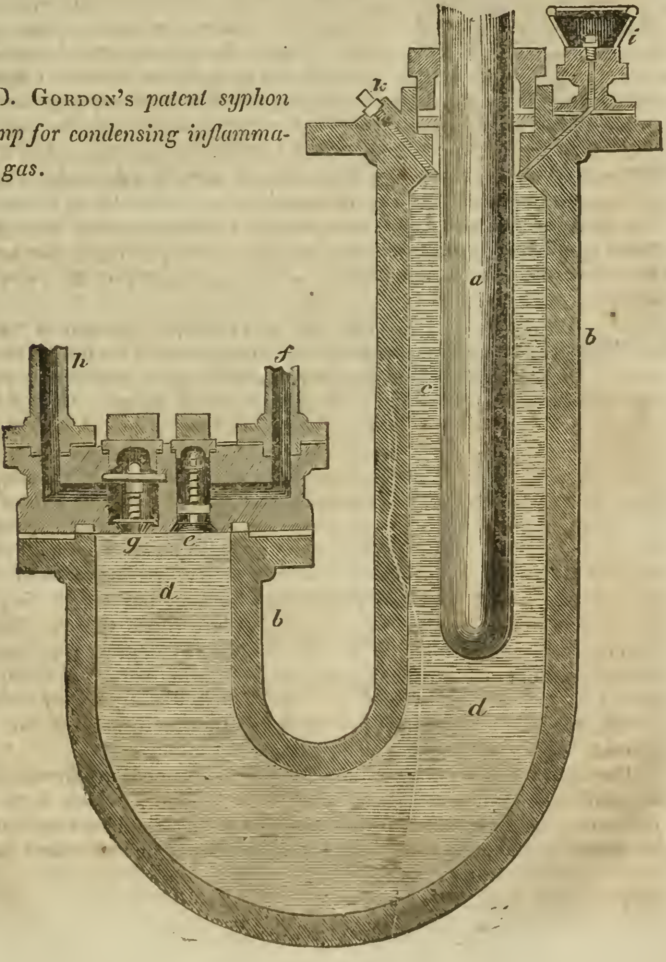
This figure exhibits a section of an improved valve for regulating the flow of the gas to the burner, with great nicety and precision. The passages for the gas *e c*, are drilled out of one solid piece of metal, and the regulating screw, *c*, is tapped into the side of the same piece; the lower part of it is adapted to screw into an aperture at one end of the reservoir of the lamp; when the regulating steel screw, *c*, is screwed up, so that its conical end fits tightly into the conical cavity, it closes it perfectly, and prevents all escape of gas to the burner; but on turning the regulating screw slightly round by its square head, the gas escapes through the passages *e c*, to the burner, in any degree that may be desired. Previously to inserting the regulating screw, it is dipped into a mixture of bees wax and oil, which fills up every minute cavity, or space, that may be left between the threads of the two screws.

The soft metal rings or collars (before mentioned) are firmly fixed by soldering, or otherwise, to one of the surfaces which form the joint; they are not therefore in danger of being displaced or injured by screwing them up hard, but produce a very tight and sound joint.

Description of the patent quicksilver syphon pump for condensing gas; as it is constructed and used at the portable gas-works, London.

THIS syphon pump was invented about four years ago, it has, ever since, been in use at the portable gas-works, in Sutton street, London, and has been found to answer the purpose intended perfectly well. The intervention of the water, and the quicksilver, between the plunger and the chamber which is to contain the gas, we think a peculiarly happy idea, as it obviates entirely the danger of the waste of gas, or the admixture of atmospheric air, from defective packing. The annexed cut will give a complete view of the whole construction of the essential parts of the instrument.

D. GORDON's *patent syphon pump for condensing inflammable gas.*



The figure *b b*, represents a vertical section of one of the pumps with the plunger *a*, at the lowest point of its descent; at this moment, every part of the syphon is completely filled with the two liquids which it contains, to the entire exclusion of air; the part *c*, shadowed with broken lines, being water, and the part *d d*, quicksilver. It will, therefore, be easily conceived that when the plunger is drawn up, an empty space or vacuum equal to the volume of the plunger will be left in the syphon; and as mercury is a much heavier body than water, the latter will be pushed up by the former, and follow the plunger as it ascends. The mercury consequently sinks below its present level, which causes the *suction valve*, *e*, to open, and to let in a volume of gas of ordinary density, which flows from a gasometer, or gas holder, through the pipe *f*. At the down stroke of the plunger, the gas is compressed and forced through the discharge valve, which opens outward, into the pipe *h*, which leads to a strong recipient, wherein the gas is condensed, as shown at *i* in the condensing apparatus. The action of the pumps being continued, the compression of the gas is effected to whatever degree may be required, not transcending the power of the engine employed. In the Portable Gas Works above mentioned, we believe there are now nine pumps at work with a ten horse engine.

The quicksilver and water are poured into the syphon, by means of the basin, and perforation at *i*, the aperture at *k* being opened to allow the air to escape; the aperture *k* is next made perfectly tight by a plug which is screwed into the orifice, during which time the water is poured in at *i* to expel the air, and fill up every crevice. Another plug is then screwed into the orifice at *i*, with the water above it. After this, the first down stroke of the plunger expels the atmospheric air on the surface of the mercury in the short leg of the syphon; and the pump is then ready to perform the office of alternately drawing in the gas from the gas holder, and compressing it into a thirtieth part of its previous volume in the portable lamps; which is done in the manner already described.

Essay on Earthenware and Porcelain.

[From Parke's Chemical Essays.]

Continued from p. 307, and concluded.

It is said that in France the very best crucibles which they have, are made with fine clay mixed up with old ground butter pots; and that these are composed of a peculiar kind of stone ware, which is manufactured in Normandy.

Where crucibles are required for melting metals, those made with plumbago are decidedly the best; but these are unsuitable for other purposes of the laboratory, especially when salts and alkaline fluxes are employed in any process.

In a paper by Vandermonge, Monge, and Berthollet, on the manufacture of steel, and which was published by order of the Committee of Public Safety in Paris, in the second year of the republic, they say, "One of the greatest difficulties we find in this country (France) is to procure good crucibles." The art of pottery in a manufacturing country like Great Britain, is, in all its parts, truly important.

More than eighty years ago the celebrated Reaumur, in making some trials on glass, discovered, that if a vessel made of the common green bottle-glass be submitted to the heat of a potter's oven, imbedded in a mixture of sand and ground *sulphate of lime*, the glass of which it is composed will be changed in its appearance, and acquire some of the properties of the best Oriental china; become so hard as to strike fire with steel; be semi-transparent like porcelain, and will endure sudden changes of temperature without breaking. An account of these results was given in the Memoirs of the Royal Academy of Sciences for the year 1739.

Having mentioned this, I have only room to add, that the late Dr. Lewis, who conceived highly of this discovery, made many experiments to ascertain its nature and importance, the particulars of which, together with several most judicious remarks upon them, will be found in his celebrated work on the commerce of the arts.

The subject, however, appears to me to be highly deserving of still further investigation, especially as useful vessels of a difficult form may be made more easily of glass than of earthenware. If, therefore, a cheap and certain method of performing this species of cementation could be adopted, the operative chemist would have it in his power to procure a greater variety of chemical vessels, and those not only more durable, but of more convenient forms than he can possibly obtain by any other means. I wish some potter would commence a manufactory of this kind. Such ware would be highly useful for many domestic purposes, to which none of the common pottery can be applied either with convenience or safety.

In returning to the subject of earthenware, it is proper I should state my opinion, that chemical vessels are often injured by the oxide of iron originally pertaining to the clay itself, as it acts like a flux, rendering this earth too fusible to admit of a proper union with the siliceous material of the ground pottery, which is employed in the manufacture of such articles. A question arises here, whether *oxide* of iron alone is prejudicial in this way, although its sulphuret, the pyrites, may be. It may, perhaps, be worth while to decide this by experiment. Macquer says, that if a bit of pyrites be left in clay which is to be exposed to a baking fire, it will form a cavity in the ware, and that this may be known by the circumstance of the cavity being stained black.

There is, in the London Institution, an old pamphlet of nine pages without title-page or date, on making porcelain, in which the writer speaks of a practice the Chinese have, of purifying the earth they employ for the glaze, by means of aqua-fortis. On reading this, it occurred to me, that it might perhaps be worth trying, whether this expedient could be adopted with advantage in purifying such of our clays as are designed for the finest purposes.

For those articles in which the chemical nature of the body of the ware is of importance, it would, perhaps, be adviseable, always to wash the clay thoroughly; for, if pyrites be contained in it, the greater part of this would subside, on account of its superior specific gravity, while the argillaceous earth remained suspended by the water. For chemical jars, still heads, &c. a *small* portion of iron would probably not be injurious. Vauquelin analyzed the clay of which Hessian crucibles are made, and found it to consist of eight parts oxide of iron, combined with 69 of silica, 22 alumina, and one carbon.

Clay which contains lime is equally improper for the manufacture of chemical vessels. If a clay be suspected to contain lime, or rather carbonate of lime, it may readily be discovered by an acid, which, if this earth be present, will occasion an effervescence. When lime does not exceed five or six per cent., it appears to do no harm to the quality of the pottery; but when more abundant, it communicates too great a degree of fusibility: in like manner, there are cases in which an admixture of the oxide of iron is useful, and even necessary.

In the manufacture of what is called Delf-ware, it has been customary to mix a portion of ferruginous clay with the other ingredients, because of its possessing a binding quality, from which other species are exempt. The following are the usual proportions: two parts of red clay, three of blue clay, and five of marle. Most of the red clay is indebted to iron for the colour which it assumes; but when iron enters in any considerable quantity into the composition of the finer kinds of earthenware, it imparts either a red or a brown tinge to it; and besides this, it adds more fusibility to it than even lime.

Recollecting the circumstance just mentioned respecting Delf-ware, it occurred to me, in reading one of the volumes of the *Archæologia*, that a certain iron-ore found in Scotland would probably be useful, when mixed in a small proportion, for some articles of pottery. I will give an abstract of the passage which caught my attention; and if any ingenious manufacturer should be able to avail himself of this hint, and convert it to profit, I shall be rejoiced, and shall at any time be glad to be informed of the result, and the respective particulars which attended it.

In the Highlands of Scotland, some very singular ancient walls are to be seen, which consist of "stones piled rudely upon one another, and firmly cemented together by a matter which has been vitrified by means of fire, and which forms a kind of artificial rock that resists the vicissitude of the weather, better than any artificial cement that has ever yet been discovered."

Mr. James Anderson, the person who has written upon these curious remains of antiquity, has found that through all the northern parts of Scotland, a peculiar kind of iron-ore of a very vitrescible nature, is found in great abundance. Hence he supposes that "when the walls were reared and made as firm as could be by dry stones piled one upon another, the interstices between them were filled with this vitrescible iron-ore, and the whole supported by a backing of loose stones piled behind it. When this wall was thus far completed, nothing more was necessary to give it the entire finishing, but to kindle a fire all round it, sufficiently intense to melt the vitrescible ore, and thus to cement the whole into one coherent mass."

Dr. Lewis has related a remarkable instance of the affinity of iron for silica. Having immersed some pieces of green glass in the red oxide of iron, which remains after the acid has been expelled from green copperas, and baked it for several hours in the upper chamber of a wind furnace, the glass and oxide of iron were found to have run together into a black mass, of sufficient hardness to strike fire freely with steel. "It is remarkable," says he, "that a metallic substance, so refractory in the fire, should be so greatly disposed to melt with green glass."

Nothing can be of more importance to a potter than a thorough knowledge of the properties of the different kinds of clays. Dr. Campbell, in his Political Survey of Great Britain, states that we have not less than twenty-two distinct species; and Macquer, who examined more than eight hundred specimens, says that in all that number he did not find one that was entirely free from metallic matter.

There is only one method, however, by which clays can be examined with any accuracy, and that is by the aid of chemistry. Such of my readers who are potters but not chemists, will, therefore, allow me to advise them to lose no time, in acquiring the knowledge of analyzing earths and minerals. Ample directions for the attainment of this art will be found in Kirwan's Elements of Mineralogy, or in Klaproth's Analytical Essays; and I conceive it impossible that any manufacturer will ever regret the time which it may be necessary for him to devote to the acquisition of that elementary knowledge, which would enable him to consult these distinguished writers with pleasure and advantage.

One or two instances of the mistakes which may occur in the examination of mineral substances, when they are not submitted to chemical analysis, will be sufficient to show the importance of this inquiry, and will, I hope, induce the junior practitioners, at least, to adopt this advice, and enter upon that course of study which will be most likely to afford profit as well as entertainment.

The precious stones were formerly classed with siliceous fossils; and until Bergman and Klaproth analyzed several of them, they were generally supposed to be entirely composed of silica, combined with a portion of colouring matter, to which they were solely indebted for their distinctive characters and appearances. An accurate analysis of several of these gems, particularly of the sapphire, the topaz, the hyacinth, and the ruby, has, however, proved that either alumina, or zircone, and not silica, is in these instances the predominant ingredient. The sapphire, according to Klaproth, consists of clay 98.50, oxide of iron 1, lime 0.50. The topaz consists of clay

46, silica 39, lime 8, iron 6. The hyacinth of zircone 70, silica 25, oxide of iron 0.50, loss 4.50. The ruby is composed of clay 40, silica 39, lime 9, and iron 10.

The well-known article called fuller's earth, from its saponaceous texture, had been supposed to consist almost entirely of clay or alumina; but on an accurate analysis, it has been ascertained, that the earth which enters into its composition in largest proportion, is silica. According to the analysis of Bergman, fuller's earth consists of silica 51.8, alumina 25, lime 3.3, magnesia 0.7, iron 0.7, water 15.5. Hence it may be accounted for, why it falls into a powder when put into water, and is incapable of forming a ductile paste. On the contrary, emery, which has very much the appearance of sand or ground silica, is for the most part argillaceous earth or alumina, and the siliceous earth is in a very inconsiderable quantity.

The last instance which I shall adduce, is one that is intimately connected with our subject, and which shows decisively how necessary it is for a potter to be capable of undertaking a chemical analysis.

The porcelain earth of Baudiffero was pronounced by Macquer and Baumé to be a CLAY, superior in quality to that which was then employed in the manufactory belonging to the French king at Sevres; and on their authority this was generally believed, till Mr. Giobert discovered that not a particle of clay could be found in it. For, when this chemist attempted to convert it into alum, he found, to his great surprise, nothing but very pure crystals of Epsom salt, or sulphate of magnesia. After this, Giobert analyzed this mineral with great care, and found it to consist of magnesia 68, carbonic acid 12, silica 15.6, sulphate of lime 1.6, and water 3.

Since that period, magnesian earth has been much employed in the composition of porcelain, it having been ascertained that a small portion of it prevents that great degree of contraction, which always takes place in the fire, when clay and silica alone are made use of. The Cornish steatites, or soap rock, being a mineral containing magnesia, some of the English potters now employ it for this purpose.

I have understood, that in England, the steatites was first used by the porcelain manufacturers at Worcester, and that they paid at the rate of £20. per ton for it. In a well-known publication it has been stated, that much of the land is in possession of the great Staffordshire houses, who have taken leases of it, for the purpose of possessing themselves of this very valuable natural production. I learnt, however, in the year 1815, from most respectable authority, that *steatites* had then never been employed by the Staffordshire potters.

The steatites of Cornwall occurs at the Lizard point, in a serpentine mountain which it cuts through in small perpendicular veins, called *rake-veins*. The finest sort is white, with blueish or reddish spots, resembling marble. The best analysis of this mineral gives silica 48, magnesia 20.50, alumina 14, oxide of iron 1, water 15 50, loss 1.

It might, perhaps, be worth while, for the glass-makers to try the effect of a small mixture of *steatites*, with the materials of which they make their large crucibles; because, if it prevent that great degree of shrinking to which they are now liable, it would be very advantageous.

I have been informed by an eminent maker of plate glass, that their crucibles, which are at first 32 inches deep, will not measure more than 29 inches when they have undergone the heat of the oven and become thoroughly baked; and that this contraction has occasioned very great loss, especially in respect to the excise duty.

These glass-house pots are very large vessels, being made to measure nearly as much in diameter at the top, as in depth, consequently the shrinking, on the whole, is very great; and as the officer of excise gauges them before they are burnt, the manufacturer incurs a loss of duty upon as much glass as might be contained in the depth of three inches, and this loss recurs every time such crucible is charged; so that a manufacturer who pays £5000 per annum in duty, must pay £500 every year more than was contemplated by the legislature.

I am very glad, however, to have it in my power to inform my readers, that since this was written for the first edition of this work, the hardship there complained of is entirely removed, the government having made an alteration in the mode of collecting the duty on glass; for, instead of gauging the crucibles, the duty is now charged on the finished glass itself according to its actual weight.

Having ventured to offer these observations, I shall conclude with a few hints, which to practical men, may perhaps be useful.

There is a clay found in the territory of Sienna, in the province of Tuscany, called *fossil meal*, and by Kirwan, Argillomurite, which is capable of making hard compact bricks that will float in water, either baked or unbaked. M. Fabroni, who examined some of these bricks, in consequence of their having been mentioned by Pliny, says that they may be of great use in the construction of reverberatory furnaces; for they are such bad conductors of heat, that although one of such bricks should be made completely red hot, from one end to its middle, any person may take it up in his hand by the other end with impunity. May it not then be worth while to inquire, whether a clay possessed of similar properties cannot be found in Great Britain?

Moreover, considering the improvements which have been made in the manufactory of pottery, might it not be easy to make bricks to imitate stone, and yet be as durable as the bricks now in use?

By means of the metallic oxides, would it not be possible at a cheap rate to stain bricks of any colour, and might not such bricks be made to imitate marble?

In the Essay on Barytes, I have stated, that Mr. Wedgwood employed the sulphate of that earth in the manufacture of jasper; but if pure barytes itself, or strontites, could be procured without much expense, might not these also be used with advantage in some of the branches of pottery? A method of employing sulphate of barytes in pottery is indeed alluded to by Sage, in one of the volumes of the *Journal de Physique*. "The Chinese," says he, "knew the remarkable property which gum adracanth has of giving a coherence to minute stony substances; which are then unalterable by fire; and that if this gum be mixed with pounded sulphate of barytes, it may be formed into masses, which neither alter their shape nor solidity from exposure to an intense fire. I have not heard that any English potter has yet availed himself of this suggestion.

The sulphates of barytes and strontites may be had cheap, and in abundance; and all that would be necessary, is to roast them in a reverberatory furnace with some combustible matter, to convert them into sulphurets, and then the remaining sulphur, should it prove injurious, could be separated by a subsequent process. In this way an ingenious manufacturer might probably gain unexpected profits and improvements from one or both of these earths.

In concluding this essay, I trust I shall stand excused, if I endeavour to confirm an opinion already given, that a potter should never employ a new porcelain-clay without previous analysis; for there are few of these clays that can be employed with the certainty of a good result, unless some fusible material be used with them; and the quantity of this can only be known by a chemical examination of the clay in question. The necessity of analysis will appear from the comparison of the chemical nature of three of these native productions. The porcelain earth of Limoges, and which is often used without any admixture, is, according to Hassenfratz, composed of 62 parts silica, 19 alumina, 12 magnesia, and 7 sulphate of barytes; whereas, the porcelain-clay of Cornwall, is a compound of 20 per cent. of silica, and 60 per cent. of alumina; while that found in the department of the Loire in France, of a beautifully white colour, consists entirely of carbonate of magnesia and silica.

The business of a potter affords so large a field for the exercise of taste and genius, and the art itself is so intimately connected with chemical knowledge and experience, that it would be superfluous to urge by further arguments, the absolute necessity of cultivating the science of chemistry, in order to arrive at perfection in any branch of the manufacture.

Remarks on Rennie's *Essays on Bleaching.*

We now present the last essay of the series on the subject of bleaching. The author of them has collected and arranged a mass of historical and practical facts, which are valuable; he has, however, left much to be desired by the practical bleacher, which we hope hereafter to supply. We have been strongly inclined to omit the concluding part, which contains the writer's theoretical views, and have published it only for the purpose of making the series complete.

To practical men, theoretical discussions are, in general, unintelligible; and unless the writer be deeply versed in the subject, he, in entering upon them, ventures on dangerous ground, being more likely to display his own weakness, than to add to the stock of our information, or to improve the mode of our arrangement. We know nothing of Mr. Rennie, excepting through the medium of his essays, which have manifested a commendable portion of industry, but his theoretical views appear to us to be, sometimes, not merely gratuitous but absurd; he however, it seems, is young, and this should be deemed a sufficient apology for that fondness for theory, which time and experience will undoubtedly chasten and regulate. [*Editor.*

ESSAYS ON BLEACHING.

By James Rennie, *A. M. Lecturer on Philosophy, &c. London.*

HINTS RESPECTING THE THEORY OF BLEACHING.

[Conclusion of the series.]

When I entered upon my inquiries into the art of bleaching, I anticipated that I should find the theoretical discussions connected with it, very instructive, and opening a wide field for philosophical research. In the first of these anticipations I have been greatly disappointed; the second has much embarrassed me; for the field of research is so extensive, and withal so impenetrable by the ordinary paths of philosophy, that I have been discouraged from attempting what Newton and Herschel, and Berthollet and Davy, have failed to accomplish. When it is recollected that it embraces the very difficult subject of colour and coloured light, as well as the most abstruse doctrines of chemistry, this will appear no way surprising. I shall, therefore, be obliged to relinquish the thought of giving a connected theory of the art, and must content myself with the few imperfect hints which have come to my knowledge. I have even left myself but little room for these, as the essay has already swelled beyond the bounds which I had prescribed to myself at its commencement. The imperfection of the theory, however, is of little moment in the practice of the art, and if the chemical bleacher can explain the proximate operations of affinity in destroying colour, he need give himself very little trouble about the ultimate causes of coloured light and its decomposition.

Newton, having been able, by means of a glass prism, to decompose a ray of white light into seven different colours, came to the conclusion, that light is made up of those colours proportionably blended, and that bodies derive their colours from their capability of absorbing or reflecting rays which are differently coloured. A cowslip, for example, reflects the yellow rays of the compound light, and absorbs all the others. It strikes me that some very curious consequences may be deduced from this theory. It evidently proceeds upon the supposition that light is material, and can be mechanically divided, which is assuming what will not be granted without proof; but allowing the assumption, how comes it that the flower leaves of the cowslip do not increase in bulk from the absorption of a continued stream of light? And ought not this effect to be very apparent in the dark petals of the night-shade, which, by the hypothesis, reflects almost none of the light that falls upon them? If it be said that plants have a particular set of organs which decompose this absorbed light, and convert it into nourishment, how will this apply to inorganic matter, coloured wafers for example, and coloured paper, which are not found to increase from this supposed absorption of light? Besides, why, if the same kind of rays, in every circumstance, is precisely similar, should some be always reflected, and others transmitted? This seems, on this hypothesis, wholly inexplicable. Later philosophers, among whom is M. Prieur, reduce the number of primitive colours to three, namely, red, green, and violet; the intermixture of red and green giving rise to orange or yellow, according as the one or other predominates in the composition, and so of the other. It is certain that by a particular mode of management, he produced white light by an intermixture of red, green, and blue rays. Delaval, in an experimental inquiry into the cause of the changes of colour, which is more laboured than philosophical, goes deeper, as he thinks, into the subject than Newton, and tells us that the result of his experiment was, that transmitted light is the cause of colour,—for all bodies being, as he says, naturally white, it is only by means of a thin transparent pellicle which covers them, and transmits the light, that they appear of different colours; according as the pellicle is thick or thin. Scrape, says he, a dyed feather, and you will find it white below this pellicle. Again, when the colouring matter of plants is extracted from them, the solid fibrous parts, thus divested of their covering, display that whiteness which is their peculiar characteristic. White paper and linen are formed of such fibrous vegetable matter, which is bleached by dissolving and detaching the heterogeneous coloured particles. It also appears, he thinks, that the earth which forms the solid substance of plants is white; that it is separable from the colouring matter by several means; that whenever it is either pure and unmixed, or diffused through transparent colourless media, it exhibits its whiteness, and is the only vegetable matter which is endued with a reflective power; that the colours of vegetables are produced by the light *reflected* from this white matter, and transmitted thence through the coloured coat, or covering, which is formed on its surface by the colouring particles, and that whenever the colouring matter is either discharged, or by solution divided into particles, too *minute to exhibit any colour*, the solid earthy substance is exposed, and shows its native whiteness. But this is assuredly a mere vision, and as unworthy of refutation as the mechanical theory of chemical combination and decomposition. Delaval's mode of experimenting was such as might prove any hypothesis, however absurd; for he seems not to have first made his experiments, and thence drawn conclusions, but to have laid down an hypothesis with which he was previously determined that his experiments should agree. This opinion acquires confirmation from the beautiful and luminous experiments of Dr. Herschel, by which he proves satisfactorily that colour does not at all depend upon the size of the particles of matter, nor on the thickness or thinness of pellicles. (*Phil. Mag.* xxx. 206.)

Another hypothesis is, that light is a fluid, and the effect of the prism is to produce a chemical rather than a mechanical decomposition; and if this were sufficiently developed, I think it is more than probable that it would afford the most rational theory which has yet been proposed.

It will here suit our purpose better, to consider light as composed of three different sorts of rays, calorific, colorific, and de-oxidizing. The latter of these seem to act chiefly in decomposing bodies subjected to their influence, and are denominated de-oxidizing from their power of disengaging oxygen from its combinations. When nitric acid, for example, which is destitute of colour, is exposed to the rays of the sun, oxygen gas is partially disengaged, and the acid becomes reddish. A similar effect is produced on the oxides of several of the metals, particularly the oxide of silver and gold, which are thus partially deprived of oxygen, and approach the metallic state. When paper, moistened with nitrate of silver, is thus exposed to the light, it immediately becomes black; and muriate of silver is similarly, and even more speedily affected. It appears, then, that light produces changes in colour more by the disengaging of oxygen than by any mechanical reflection or transmission of its rays or particles. It will follow that oxygen is a principle much concerned in the original production of colour. This is confirmed by several facts which I have been at some pains to collect. When too much oxide has been employed for purifying flint glass so as to occasion purple colour in the plates, it is usual to thrust a piece of wood into the mass of melted metal, which quickly abstracts the colour. The oxide seems to impart its colour to the glass only when it is in a high state of oxidizement: the wood therefore becoming carbonized, abstracts a part of the oxygen, and the *colour of the glass disappears.* (*Parke's Ess. on Glass*, Note v. 203.) That oxygen is the colouring principle seems probable also from this, that the woollen dyers cut their logwood into chips, sprinkling it abundantly with water, and in this moistened state, throw it into great heaps, where it lies till the chips become heated, or fermented. After lying a few months in this state, they give out their colouring matter in the dying copper much more easily, and in greater abundance. This may be accounted for, by supposing that the water becomes in part decomposed, and that the oxygen uniting with the colouring matter renders it more intense, similar to the case of fruits, which deepen in colour as they ripen, by their gradual absorption of oxygen, (*see Ann. de Chim.* vi. 80.) When salts become coloured by accident, the manufacturing chemist employs charcoal to purify and clear them. He dissolves the salts, boils the solution on charcoal, and when recrystalized, they are found to be pure and colourless. (*Parke's Ess. on Carbon*, ii. 311.) Now does not this, I would ask, arise from the property which charcoal has of absorbing all the known gases, and condensing them within its pores in quantities, far exceeding its own bulk? *See Journ. de Phys. An.* 12, where Morozzo proves this by a series of experiments. And does it not appear plain that the charcoal, in the case in question, absorbs the oxygen gas, and so effects the destruction of the colouring matter of the salts? The phenomena exhibited by sympathetic inks seem all to countenance this idea. That prepared with muriate of cobalt, for example, which appears and disappears according to the presence or absence of a certain quantity of caloric. When the muriate of cobalt is pure, it produces with caloric a beautiful blue; when mixed with iron, the blue becomes green. Now, in this case, does it not seem probable that the caloric facilitates the combination of the oxygen of the atmosphere with the metal? or is it the caloric itself which is the colouring principle? Thenard found that when a piece of purified phosphorus of a pale yellow colour was melted in *hot* water, and then plunged into *cold* water, it became perfectly black, and always recovered its original colour upon being re-melted. Biot confirmed this, and attempted to show that colour depends on the mechanical condition of the component particles of bodies. A fact analogous to that stated by Thenard, was observed by Dr. Brewster in preparing prisms of realgar by melting it between glass plates. This substance is naturally of a dark orange red, but it became darker as the heat was increased, till at a certain temperature it became quite black; when cold it recovered its original red colour. Mr. Brande states that when nitrous acid gas is exposed to heat, its orange colour becomes more intense, so as to appear nearly black. (*Journ. of Sc. and Art.* i. p. 200.) M. Hermstaedt concludes from a series of well conducted experiments on the colouring principles of cochineal, (*Phil. Mag.* xiv. 319.) that many of the metals and earths possess a certain chemical affinity for this principle, and that the *acid*, which serves as a solvent for these substances, exercises a great influence on the shades produced. Oxygen also he found to affect, considerably, the production of scarlet by the muriate of tin, when oxidated by the air. The same doctrine seems to be farther confirmed by the very interesting and curious experiments of sir Francis Ford, (*Phil. Mag.* i. 100.) who found when oxygen was diffused through water, and sprinkled on flowers, that they assumed more brilliant colours, and even, in some cases, had those colours considerably changed. It has also been thought by some of the ablest chemists of the age, that oxygen is the agent which affects the colour of the blood. Those facts might easily be multiplied almost to infinity. I shall, however, hold these to be sufficient. *See Bancroft*, p. 15.

But granting it proved that oxygen is one of the chief principles which produce colour, we are still totally in the dark, as to the manner in which it acts, in the case in question. Does it decompose the rays of light? or does it modify their action on the organs of vision? If it does so, why does it not always produce the same effect, or, in other words, the same colour? If light be a fluid composed of different particles, is it by atoms of oxygen combining with these in definite proportions that the phenomena of colours are produced? If so, how many atoms of oxygen, in combination, constitute, for example, a green colour?

During the course of the essay, I have frequently mentioned the colouring matter of the several stuffs; were I to be asked what I understand by this colouring matter, I would answer, I do not mean any definite chemical principle, such as oxygen, or tannin, but use it as a general expression for oils, resins, gums, or other chemical constituents which may be tinged with any colour. Several of our illustrious modern chemists have attempted to show that there exists, chiefly in vegetables, a proximate principle, distinct from every other constituent of plants, in which colour principally resides, and to which they give the name of colouring matter. The evidence which is adduced for the existence of such a principle, seems to me, to be extremely vague and doubtful, and there are facts which appear nearly conclusive against its existence. If there were such a principle, it ought, according to the analogy of some similar principles, to possess invariable characteristics by which it might always be recognized. Nothing like this, however, has yet been discovered. Certain vegetable colours, indeed, such as red and blue, are uniformly affected in the same manner, by acids and alkalies; but does this prove that the blue and red are similar properties of the *same* colouring principle? does it not rather prove that those two colours are widely dissimilar, and give reason to infer, that the principle upon which they depend, is also very different in some of its properties? Mr. Murray tells us that many vegetable products, possessed of deep, or of vivid colours, agree in certain chemical relations: the colouring matter can be abstracted from them by the application of certain solvents; can be still farther transferred from these solvents to other substances, exerting affinities towards it; and this, without it being possible to refer the phenomena to actions exerted by any known proximate principle. But surely this evidence can never be admitted as proof of the existence of a separate principle. If the phenomena cannot be referred to the action of any *known* proximate principle, it may reasonably lead us to conjecture the existence of some such principle; but does it necessarily follow, that this must be colouring matter, distinct from the other constituents of the plant to which it gives colour? The colouring matter of vegetables, it is said, is scarcely ever found insulated, but is mixed or combined with other principles; and that it is obtained in a more simple and pure state by the action of those agents which are capable of dissolving it. But I would observe, that this supposed colouring matter has never, so far as I know, been obtained in a simple state, unmixed with gum, resin, oil, or other known vegetable constituents, which, although it is not a proof of its non-existence, is sufficient to make us cautious in admitting what appears so doubtful. Sometimes the colours of vegetables are extracted by water, which must be cold or warm, according to circumstances; for even in so simple a thing as this, there seems to be a diversity of affinities in this principle. It is not always soluble in water, but recourse must sometimes be had to alcohol, and even, in one instance, to essential or expressed oil. Alkalies and acids, also, must sometimes be employed before its solution can be effected. Now it can easily be conceived, that when it is in complicated combination with resin, gum, tannin, and the like, the operation of different chemical agents may be required, for its separation; but when once the separation is effected, it ought to exhibit common properties, otherwise it can never be esteemed a distinct principle.

It appears, then, that we can receive but little light on the theory of bleaching, from what has been written by chemists, concerning the colouring matter of plants, considered as a distinct, proximate principle, any more than from the vague hypothesis which philosophers have given concerning colour, and coloured light. What is known concerning the operation of the chemical agents used in bleaching, is also founded chiefly on conjecture. When treating of these agents, and of the several processes of the art, I have already given the most probable rationale in the greater number of instances, and shall not now repeat what was then stated. The rationale of the action of the most important of those agents, namely, chlorine, I have reserved for this place.

Berthollet, and most of the earlier chemists of the modern school, if we except Scheele, supposed, that what we called chlorine is a compound substance produced by a union of muriatic acid and oxygen, whence they denominated it oxy-muriatic acid, or oxygenated muriatic acid. This account of the matter is now nearly abandoned by all the eminent chemists of the day, except Berzelius and perhaps Dalton. The most probable account, is that which has been illustrated at great length, and with much ingenuity, by sir Humphrey Davy, and of the merit of which a most preposterous attempt has been made to deprive him by the French chemists, because Gay-Lussac and Thenard, overawed by the authority of Berthollet, *argued against it* in their '*Recherches Physico-Chimiques*,' while all the time they secretly believed it to be just. But if so, why did they not publicly say so, in contempt of Berthollet's authority?

It will be proper to state, as briefly as possible, the reasons for considering Davy's theory to be the most plausible, if not the true, account of the substance. Not the least striking of these is its conversion into muriatic acid, by union with hydrogen, while, during the change, it evolves no aqueous vapour. Sir H. Davy, and Dr. Henry, have satisfactorily proved that water is an essential ingredient in muriatic acid, as the latter has never been procured in an insulated, elastic form. Berthollet makes the proportion of water as high as 34 per cent. but it is probable, that at a minimum, the proportion may be 25, as stated by Gay-Lussac and Thenard. This view of the subject is opposed by Dalton. (*Chem. Phil.* i. 282.) He argues, that when the gases which are not readily absorbed by water, are brought into contact with it, and exposed to heat, a portion of the fluid will be raised into their interstices; but if acids in the state of a gas which can be absorbed by water, readily, and in quantity, are placed in similar circumstances, there is a mutual attraction, and their consequent union produces an acid in the liquid form. It follows, he thinks unanswerably, that these acid gases of which the muriatic is one, so far from obstinately retaining their vapour, cannot be induced to admit any vapour at all in ordinary circumstances. But in making his experiments, Mr. Dalton does not seem to have been aware, that his muriatic gas was previously saturated with aqueous vapour, as it unquestionably must have been, and could not, on this account, admit the absorption of an additional quantity. Would Mr. Dalton affirm, that muriate of lime contains no water of crystallization, because when a very small portion of water is added to its crystals, they become liquid? Now, when it is recollected, that one cubic inch of oxygen, by union with very nearly two cubic inches of hydrogen, forms a quantity of water, whose weight is to that of the real muriatic acid contained in two inches of the acid gas, as 26 to 100, we must conclude that the oxygen of the chlorine, if it contains any, most unaccountably disappears; or, rather, that it has no existence. Dalton has reasoned against this very plausibly, and supported his arguments by ingenious experiments, but he has been satisfactorily answered by Mr. Henderson in a learned paper, for which he received a medal from the Royal Medical Society of Edinburgh.

Again, chlorine, when caused to exert its action on metals, and inflammable substances, produces bodies which are essentially different from oxides produced from the same substances. The most satisfactory proof of this position has been brought forward by Mr. J. Davy, in a paper on the metallic combinations of chlorine. (*Phil. Trans.* 1812, 169.) He combined it with copper, tin, iron, manganese, lead, zinc, arsenic, and bismuth, in most cases in several proportions, but in no case did he obtain any substance resembling the oxides of the same metals. In examining Mr. J. Davy's experiments, Henderson has stated a curious coincidence of the new and the old theory. Horn-lead, he remarks, is said by Mr. J. Davy to contain 74.22 lead, and 25.78 chlorine. According to Kirwan's Analysis, it has 76 of lead, and 18.23 of muriatic acid; which, by the new theory, can yield only 17.6 of chlorine. In this case, the proportions of lead seem to answer very well; but that of chlorine is over-rated, by 8.18 per cent. By Kirwan's Analysis also, horn-lead contains 5.77 of oxygen, which, on the principles of the old theory, is sufficient to form 25.64 of oxy-muriatic gas, by union with muriatic acid. Is this, he asks, merely accidental?

The opponents of the new theory, confess, that the strongest circumstance in its favour, is, that charcoal is neither capable of decomposing chlorine gas, nor muriate of silver, at any temperature whatever; in which cases, the strong affinity of the charcoal, for oxygen, ought to come into play, where oxygen is present in the chlorine, or its compound. This plain, and one should suppose unanswerable, fact, is opposed, not by one equally plain and satisfactory, but by general reasoning on the known laws of chemical combination. Berzelius, (*Ann. of Phil.* ii. 256.) remarks, that the most simple explanation is not always the most accurate. If, indeed, we suppose that the radicle of muriatic acid has a stronger affinity for oxygen than charcoal has, there is no difficulty in explaining the want of action of charcoal on chlorine. But this supposition is evidently quite gratuitous, and can never be allowed to weigh in argument against an indubitable fact. The objections of Berzelius also, which are derived from the general chemical laws which he has established on extensive inductions, must be set aside; for it is contrary to every legitimate mode of philosophizing, to cause nature to bend to any artificial arrangements, which even the most eminent and profound philosophers may see cause to lay down. Nay, Dr. Thomson says that he can point out a complete agreement between those laws of Berzelius, and the theory of Davy. (*Ann. Ph.* vii. 27.) He has not, however, published such an explanation, and I am too young a chemist to be able of myself to perform what appears so arduous a task. But I have full confidence in the assertion of Dr. Thomson, as his known character as a chemist induces me to rely on him. I think, then, that I am justifiable in stating, that the account of chlorine given by sir H. Davy is, if not the truth, by far the most probable which has been published.

We shall now close by considering the effect of chlorine in destroying colours, in the processes of bleaching. Berthollet (*Ann. de Chim.* ii.) supposes that it destroys colours by parting with its oxygen, which unites with the colouring matters, and produces their decomposition, either in a gaseous state, in which case they were carried away by their volatilizing, or in a liquid form, which the dash wheel could readily remove. Davy's explanation, however, is the more probable in so far as his theory of chlorine is so. He thinks, with Berthollet, that colouring matter is destroyed by uniting it with oxygen; but he thinks that the oxygen is wholly derived from the water which is always present in the chlorine preparations. This water is decomposed by double affinity; namely, that of hydrogen for chlorine, and that of colouring matter for oxygen. The virtue of chlorine, then, seems to consist in its power of detaching oxygen from the water contained in the oxy-muriates of lime, magnesia, &c. The chief circumstance, therefore, to which the bleacher should direct his attention in using the oxy-muriate, is that the salt which remains after the abstraction of the oxygen, should not act upon the fibre as it undoubtedly will, if not carefully managed.

Nothing could be easier than to extend these discussions, but as they are at best but vague conjectures, I consider that practical bleaching would receive but little advantage from prolonging them, and the chemical bleacher would assuredly rise dissatisfied from their perusal.

ON GILDING.

We now commence the account of the art of gilding upon metals, by means of an amalgam of gold with mercury; according to the method pursued in France. This article as given in the *Dictionnaire Technologique*, is too long to be completed in the present number, and too important to admit of much abridgment; the remainder, therefore, is necessarily reserved for the first number of the next volume.

This species of gilding, by the English called *water gilding*, is performed upon several different metals, and alloys, as upon silver, copper, brass, and pinchbeck; which latter is an alloy of copper and brass, or of copper with a smaller portion of zinc, than enters into the composition of brass. This alloy, as well as that of copper and tin, the French denominate bronze, whilst we, in general, restrict the latter term to compounds of copper and tin, only. In gilding upon metals, the colour, beauty, and quantity of gold required, depend much upon the nature of the alloy upon which it is laid; that which consists principally of copper and zinc, is to be understood in the following article, where bronze is named.

GILDING UPON BRONZE.

The art of gilding upon bronze has been perfectly described by M. D'Arcet, in a memoir on the art of gilding on bronze, which, in the year 1818, obtained the prize from the Academy of Sciences. From this memoir, we will now extract as much as shall appear necessary to describe the art, and to make known the improvements, which M. D'Arcet has introduced in the mode of conducting it. Those who wish for further details, we must refer to the original memoir.

The art of the gilder consists in the application of gold over a surface of bronze, by the assistance of mercury, with which the gold is amalgamated; the mercury is evaporated, and the gold fixed, by the application of heat; it is then *burnished*, or left *mat*, in whole, or in part, according to the nature of the work.

The gold should be pure, or very nearly so; it should be made very thin, either by the hammer, or the flatting mill, to expose a large surface, and favour its dissolution by the mercury. The mercury employed should also be perfectly pure, as the impurities which it contains, will otherwise be deposited with the gold, on the surface of the bronze, and consequently deteriorate the work.

Preparation of the amalgam of gold.

The workman, after weighing the fine gold which is to be amalgamated, puts it into a small crucible, which is placed in a charcoal fire, on the bed of the forge; the crucible is heated to a light red, and the requisite quantity of mercury thrown in; the mixture is stirred with a small iron rod, bent for the purpose, suffering the crucible to remain for a few minutes upon the fire, until it is known that the combination is effected: the amalgam is then thrown into a small pan containing water, and carefully washed, by squeezing it with the thumbs against the edges of the vessel, allowing all the running mercury to escape, which can be in this way separated. The amalgam which adheres together, so as to be capable of sustaining the impression of the finger, must be protected from dust, as it is that which is to be used in gilding, in the manner to be described.

The larger the proportion of mercury in the amalgam, the thinner will be the coat of gold deposited on the article to which it is applied, and *vice versa.* It is easy to conceive that amalgams may be formed of various proportions; the ordinary composition, however, is formed of 8 parts of mercury, to 1 part of gold. The mercury in this case is in excess, for after straining it through chamois skin, so much is separated as to leave in a hundred parts,

Mercury,	33
Gold,	67
	100

The running mercury which is separated by the pressure of the fingers, contains a considerable portion of gold in solution; it is an amalgam with a large excess of quicksilver, and is used either in making fresh amalgam, or in giving a coat to such articles of brass as are intended to be very lightly gilt.

Among other precautions to avoid injury to the workman, he should be careful to compress the amalgam with chamois skin, and to wear leather gloves during the operation.

Preparation of the Nitric solution of Mercury.

The prepared amalgam is applied to the work by the aid of nitric acid, holding a small portion of mercury in solution. The following is one of the methods recommended by M. D'Arcet. Into a glass matrass put 3¼ troy ounces of mercury, and 4½ of pure nitric acid, of 36° (sp. g. 1.333;) the matrass is to be placed under a chimney with a strong draft, and suffered to remain until the solution is complete.

This is to be poured into a bottle, and 11 and a half wine pints of distilled, or rain water, added to it, agitating it well, and preserving it for use.

Gilding.

After these several preparations have been obtained, the gilding is effected in the following manner.

1st. When the work has been completed by the turner, or the chaser, it is to be *annealed*, for which purpose it is placed upon lighted charcoal, and surrounded with the same, or, in preference, with cakes of tan, which affords a more equal and less intense heat; it is to be completely covered in order to prevent oxidation. It is to be carefully watched, to prevent the thinner parts from being more highly heated, than those which are thick; this operation is best performed in a dark place. When the piece has arrived at a cherry red, the workman removes the coals, and, with a pair of long handled tongs, places it where it will cool slowly.

2. *Pickling and Dipping.*—The design of this operation, is to remove from the bronze, the coating of oxide, with which it has become covered in *annealing*.

The piece is put into a wooden or earthen vessel, containing sulphuric acid, very much diluted with water: it is there left until the oxide is entirely dissolved, or at least softened, when it is to be rubbed with a rough brush; when the piece has been well pickled and washed, it is to be dried. The surface will be still discoloured, and it is to be dipped into nitric acid of 36° of Baumé (sp. g. 1.33,) and rubbed with a long haired brush; this exposes the metallic surface, but does not render it sufficiently clear: in order to obtain a fine metallic lustre, it is dipped into nitric acid of the same strength, into which is thrown a little soot, and common salt. This last circumstance induced M. D'Arcet to apprehend, that the cleansing might be effected perfectly, by using sulphuric and muriatic acids, instead of nitric acid, which last attacks the pure copper with much greater ease and force, than these two acids. In every instance, he observes, the dipping, when well performed, ought to dissolve nothing more than the oxide formed on the surface of the piece, during its annealing, and not attack the metal itself in any degree, which it is difficult to prevent, when the dipping is performed with nitric acid.

The dipping having cleaned the surface, the piece is to be carefully washed in a large portion of water, and rubbed in bran, or in the saw-dust of some wood which is free from resin; this will dry it perfectly, and prevent the tarnishing of the surface from humidity. The piece ought now to appear bright, and perfectly free from oxide; the metallic surface should be every where perfectly seen, and should exhibit a fine pale yellow colour; it should also appear grained, or lightly matted. If too smooth, the gold will not readily adhere, and if too deeply matted, the gilding will require a quantity of gold which will render it too expensive.

3d. *Application of the Amalgam.*—The piece being prepared as directed, is ready for the application of the amalgam, which should be put into a flat earthen dish, which is unglazed, and of a rough surface; a *gilder's scratch brush*, or a pencil made of fine brass wire, is to be dipped into the solution of mercury in nitric acid, of which we have already spoken.

The scratch brush is then pressed upon the amalgam, which by giving the earthen dish a slight inclination is left on its side; by drawing the scratch brush towards himself, the workman charges it with the desired quantity of amalgam, which is then applied to the article intended to be gilt; this is to be spread carefully over the work, dipping the scratch brush again into the acid solution, and into the amalgam, should this be necessary. A skilful workman will deposit a larger portion of the amalgam, on those parts where it may be desirable to gild with greater strength.

The piece is then to be washed in a large quantity of perfectly clean water, and which has not been used for previous washings; it is then dried, and carried to the fire to volatilize the mercury. Should the first coating of gold not be sufficient, the piece is again washed, and the operation repeated in the way already described.

4th. *Volatilization of the Mercury.*—When the work is properly covered with the amalgam, the gilder places it upon lighted charcoal, turning it about, and heating it slowly to the requisite degree, withdrawing it from the fire with a pair of long handled tongs, held in the left hand, which is guarded from the fire by a thick, wadded, leather glove; with a long haired brush he dabs and rubs the whole surface, so as to spread the amalgam equally, turning it in all directions, for this purpose.

The piece is then replaced upon the fire, and heated with the same precautions as before, until the mercury is completely volatilized, which is ascertained by the noise made by a drop of water, which the workman throws upon it, and also by the time which the drop requires to evaporate. During the operation, he repairs those spots which may be defective, being careful to volatilize the mercury very slowly. When the work is perfectly covered with gold, it is carefully washed, and scratch brushed, in water acidulated with vinegar.

If the work is to be partly burnished, and partly mat, the part which is to be burnished, is to be covered with a mixture of whiting, powdered sugar, and gum, tempered in water. This operation the workman denominates *guarding.* When the workman has *guarded* these parts, he dries the piece, and again heats it sufficiently to drive off any mercury which may yet remain; this he perceives by the colour which the work assumes, and by the blackening of the coat of *guarding.* After this he plunges it, whilst yet warm, into water acidulated with sulphuric acid, washes it, wipes it dry, and burnishes it.

5th. *Burnishing.*—This is effected by rubbing the piece with burnishers made of *hæmatite* or blood-stone. The burnishers are dipped in vinegar and water, and the work, in burnishing, always rubbed in the same direction, passing the instrument backward and forward, until the required lustre is obtained. When the burnishing is completed, the piece is washed in cold water, wiped with fine linen, and gently dried upon the bars of a chafing-dish containing lighted small coal.

6th. *Matting.*—The parts to be burnished, if such there be, having been covered with the *guarding*, the piece is attached, by fine iron wire, to the extremity of an iron rod; it is then highly heated, until the *guarding* becomes brown, in consequence of the roasting of the sugar, and the scorching of the gum which enters into its composition. The gilding will thus acquire a fine gold colour; it is then to be covered with a mixture of common salt, nitre, and alum, liquefied in the water of crystallization which these salts contain; the work is again carried to the fire and heated, until the saline coating becomes of a homogeneous texture, nearly transparent, and is in a state of real fusion; the piece is then withdrawn from the fire, and suddenly plunged into cold water, which will remove the saline coating, and also the *guarding.* The work is afterwards dipped in very weak nitric acid, washed in abundance of water, and dried, either by exposing it to the air, warming it upon the chafing-dish, or gently wiping it with clean, dry linen.

[TO BE CONTINUED.]

ESSAYS ON LITHOGRAPHY.—No. V.

MANNER OF PROCEEDING IN EXECUTING WORK OF DIFFERENT KINDS UPON STONE.

Autographic processes.

We have said, that the autographic process, consists in transferring a writing or a drawing, to stone. To effect this, the drawing or writing, is made with ink, on paper; both, prepared in the way we have described. A crayon drawing may, on an emergency, be executed autographically; but this mode of procedure is too imperfect to admit of procuring, by its means, neat and perfect proofs. Besides it is as expeditious to draw immediately on the stone.

In order to write, or to draw on autographic paper, a little of the ink, of which we have given the composition, is diluted in water; taking care to use only rain water, or such as will readily dissolve soap. The dissolution is facilitated by slightly warming the water in the cup; and the ink is dissolved by rubbing the end of a stick of it, in the manner practised with Indian ink. There should be no more dissolved at a time, than will be used in a day; for it does not re-dissolve so well, neither is the ink so good, particularly for delicate designs, after it has been left to dry for several days. This ink should have the consistence of rather thick cream, so that it may form very black lines on the paper; if these lines are brown, good impressions will not be obtained. A sheet of white paper is placed under the hand, while writing, in order that it may not grease the autographic paper.

The stone used for autography, should be polished with pumice stone; and the impressions will be neat, in proportion as the stone is well polished. Autographic work may be executed either cold or warm; that is, either taking the stone at its ordinary temperature, or making it warm by placing it near the fire, or exposing it to the heat of the sun; if the first means of warming it be used, care must be taken that the fire is not too hot, or it will crack the stone: the temperature given to it should be about that of an earthen vessel filled with lukewarm water. The work may be done, though less perfectly, without warming the stone.

When the stone is thus prepared, it is fixed on the press, and the paper on which the writing is made, is applied to it. The stone may be rubbed with a linen, slightly moistened with spirits of turpentine; and in every case it is necessary that it be made perfectly clean. The turpentine is left to evaporate; and from five to eight minutes before the paper is applied, it is wetted, with a sponge and water, on the reverse side to that on which the writing is done, so that the moisture may penetrate throughout every part. The water, however, must not appear on the paper when it is about to be laid on the stone; but any superabundance which may remain on it, must be removed by a pressed sponge. When the paper is brought to the proper state, it is taken, by both hands, at one of its extremities, and placed lightly and gradually on the stone, so that there may be no plaits formed in it, and that it may be equally applied over its whole surface. Care must be taken so to fix the scraper, that it may bear steadily on the autographic paper, for if it removes it at all, it will change the place of pressure, and the lines will be doubled. There should be ready at hand, five or six sheets of very even mackle paper, so that they may be changed with each impression. The paper on which the writing or drawing is made, being placed on the stone, it is covered with a sheet of mackle paper, and subjected to a slight action of the press, then to a second, a third, or even to more, until it is believed that the writing is perfectly transferred. At each stroke of the press, the mackle paper, which has imbibed moisture, is withdrawn, and a dry sheet substituted in its place. All these operations require to be performed with expedition and dexterity; particularly when the stone is warm. The next thing is to detach the autographic paper, which will be found adhering closely to the stone. To effect this, it is well wetted with a sponge, so that every part of it may be perfectly penetrated by the water; it may then be removed with facility, entirely detached from the writing, which will remain adhering strongly to the stone. If this operation, which requires some practice, be well performed, there will not be found the slightest trace of ink remaining on the paper. Should there be any lines not well marked on the stone, they may be retouched with a pen; or, which is better, with a hair-pencil and ink: but when this is done, care must be taken that the stone is quite dry.

A part of the sizing of the paper may be found dissolved, and adhering to the stone; this may be removed by washing, or slightly rubbing it with a wet sponge. The stone is then prepared with aqua fortis, and the impression taken in the way we shall describe in another number of this journal.

Autography is not confined to the transferring of writings or of drawings done with autographic ink. By its means, a transfer may be obtained from a sheet of ordinary printed paper, and with such exactness, that it would be impossible, excepting to well practised eyes, to perceive the least difference between that printed in the usual way, and that which was the result of the autographic process. This mode is very useful when it is desired to unite oriental characters, which we may not possess, with words, phrases, or lines, composed in our ordinary typography. We have thus executed many pieces in which the French, or the Latin language, was intermixed with words, or phrases, in Chinese, or Arabic. We have, in the same way, executed a typographic map, in which all the details were lithographic, while the names of places were at first produced by typography, and afterwards by autography. This operation is begun, by composing, and arranging, in a typographic form, the words, the phrases, or the lines, as they ought to stand. The autographic paper is printed on by this form, and the words in the oriental languages are afterwards written in the spaces which had been left for them. The whole is transferred to a stone, which is prepared for the purpose, and from which the impression is taken, in the usual manner. The same mode is pursued in making geographical maps. After having printed the names, on autographic paper, the other parts of the map, but without the names, are drawn immediately on the stone; and after having printed the names on white paper, the map, drawn upon the stone, is printed on this same paper.

Maps, or line engravings on copper, where the work is not very close, may be multiplied in a similar way. For this purpose, the plate of copper is covered over with the autographic ink, diluted to a convenient consistence. Instead of the autographic ink, a composition is sometimes used, made of one ounce of wax, one of suet, and three ounces of the ink with which the ordinary impressions in lithography are taken. The whole is warmed and mixed well together, and there is a little olive oil added to the composition, if it is not liquid enough to spread itself over the plate. The plate ought to be warmed as usual. After having taken the impression in the rolling press on a sheet of autographic paper, the transfer may be immediately made on the stone, after having rubbed it with a sponge, dipped in turpentine. It is necessary to give three, four, or even more, strokes of the press, increasing the pressure at every successive stroke; the other processes, which we have already described, are likewise to be followed. It is well to wait twenty-four hours before *preparing* the stone, in order that it may be better penetrated by the transferring ink; it is then gummed, and washed, and is ready for use.

This process, which has not yet come into use amongst lithographers, merits the attention of artists: for it affords the means of reproducing and multiplying geographical charts, and some kinds of engravings, indefinitely; so that they might be furnished at a quarter of their present actual value. In fact, all those which are done in lines, or those in which the shadows are boldly executed, are capable of reproducing good impressions by means of autography. The operation becomes extremely difficult when it is necessary to transfer fine line-engravings; the lines of these are so delicate, and so near to each other, that they either do not take well on the stone, or are apt to be crushed and confounded together, by the effect of the pressure. Much practice and address are necessary to obtain tolerable impressions; and this part of the art requires improvement. We have, however, succeeded in transferring to stone, a small, highly finished engraving, which had been printed on common half-sized paper. After having dry polished a stone, very perfectly, we warmed it, rubbed it with spirits of turpentine, and applied the engraving to it. This, however, had been previously dipped into water, then covered, on the reverse side, with turpentine, passed again through the water, so as to remove the superfluous turpentine, and then wiped with unsized paper. In this state, the engraving, still damp with the turpentine, was applied to the stone, and submitted to pressure, when it afforded us very good impressions; the *preparation* not being applied until it had remained on the stone for twenty-four hours. The difficulties increase, of course, in proportion to the size of the engravings which it is desired to transfer to the stone.

Attempts have been made to transfer old engravings; they have, however, succeeded but imperfectly: it would be rendering an essential service to the art, to discover a mode of reproducing old engravings by means of autography; the thing presents great difficulties; still, from the attempts of the kind which we ourselves have made, we think it possible to succeed. It shall suffice us, at present, to give some account of the mode we pursued. The ink of old engravings being brought to a state of complete dryness, it is necessary to give it a body, and unctuosity. To effect this, the engraving may be well soaked in water in which some soda, sal ammoniac, or salt of sorrel, has been dissolved. The engraving is then stretched out on a plank, and spirits of turpentine spread over it; pressing it in with the finger, or the palm of the hand, so that the lines of the engraving may be perfectly impregnated with the turpentine: it is then laid on a warm stone, submitted to pressure, and removed from the stone by wetting it with water. If the engraving has been made too wet, it should be gently pressed between some sheets of unsized paper, before placing it on the stone. It should be inked afterwards with the roller, or, which is better, with the *retouching ink*, of which we have given the composition. For this purpose a printer's ball is used; these are made of wool, and covered with thin, untanned leather.

The autographic process presents great advantages in a variety of circumstances, and in different kinds of work; particularly when economy and expedition are necessary. It is especially adapted to the circulation of all such writings as require an immediate publication; such as advices relative to commerce or to private or public interests; to memoirs, or to scientific, or literary communications, &c. which are only intended for a small number of persons; any one might have a press and use it by himself, or with the assistance of his agents, or his servants. In this manner, and in a way the most economical, geographical charts, geometrical figures, and every kind of design made with the pen, might be produced. Authors who have any knowledge of drawing, might themselves execute their works on autographic paper, without having recourse to artists: for it requires a certain apprenticeship to be able to write or to draw, backwards, with ink on a stone.

On Grinding and Polishing Lenses, for Optical Purposes. By THOMAS GILL, Esq.

FOR the knowledge of the following valuable manipulations, we are indebted to an old and experienced workman, formerly in the employ of the celebrated Mr. Tully, of Islington.

Of the Gauges for Convex and Concave Grinding-Tools.

The mode of forming these is truly ingenious. A glazier's diamond being fixed near one end of a bar of wood, in the proper situation for cutting, holes are made through the bar at proper distances, according to the lengths of the foci of the intended lenses, and a piece of crown window-glass, being secured firmly upon a table or work-bench, a brad-awl is passed through one of the holes in the bar, and affixed in the table, as a centre; and the piece of glass is then cut through with the diamond, thus forming correspondent convex and concave gauges at once. The edges of these gauges are then rubbed or ground against each other in the following manner. One of them being securely held upon a table which is wetted with a mixture of emery and water, the other is rubbed against it, continually changing their sides and ends, until the curves are perfected. The workmen generally prefer, for this purpose, those pieces of crown glass which have upon them parts of the smooth rounded edges of the semi-circular plates of glass.

Of the Patterns for Casting the Grinding-Tools.

A convex and concave pattern is turned in well-seasoned wood, to the exact curves of the gauges, of a proper thickness for the tools, and having short cylindrical stems at their backs, for screwed holes, which are to fit upon the screwed arbor or mandrel of the lathe.

Of the Grinding-Tools.

From each of these patterns, a cast-iron and a brass tool must be formed; and screwed holes being made at their backs, to fit upon the lathe mandrel, their surfaces must be carefully turned to the gauges. In order to remove the marks of the turning tools, pieces of old broken flat files are laid in, or upon, one of the surfaces; the backs of the pieces of files having previously been coated with a sufficient thickness of the cement to be afterwards described; the other corresponding convex or concave grinding-tool, must then be heated over a fire, until it will cause water dropped upon it, to hiss or form air-bubbles; when it is to be applied to the cement on the pieces of files, and be immediately cooled, by wiping its back all over with a sponge wetted with water. The pieces of files are then to be worked, or rubbed over every part of the turned surfaces, to bring them nearer to truth; and, finally, blocks of lenses must be ground in them, to perfect them, in the manner to be hereafter described.

To Prepare the Glasses for Grinding.

These must be chosen of the proper thickness and quality of glass, as free as possible from veins or blebs; and be clipped (or *nibbled*, as the operation is termed,) by means of well-known iron instruments, into equally-sized circular pieces. Seven of these are usually ground at once; viz. one in the middle, and the others surrounding it. Before finishing them in the brass tools, however, they are rough-ground on the cast-iron tools singly; in order to which, their backs are coated with cement, to a sufficient thickness to form handles to hold them by, by pouring the melted cement from an iron ladle upon them in succession, as much at a time as will conveniently lie upon them without running off, and renewing these coats till the required thickness is obtained.

These are then worked in, or upon, the cast-iron tools, with the assistance of that kind of emery termed by the makers, No. 2, *corn emery*, and water, until their surfaces shall have become nearly convex or concave; the tool is placed in a shallow wooden trough, to catch and retain the emery, which is afterwards washed over, (in the manner to be described,) to finish the grinding.

Of the Cement for fixing the Glasses on the Grinding-Tools.

This cement is made of common pitch and sifted wood-ashes, melted together in proper proportions to give it a due consistence, according to the temperature of the weather.

On finishing the Grinding of the Lenses.

The rough-ground glasses being placed in the manner above described—with their faces in, or upon, the surface of one of the brass grinding-tools (the cement on their backs having, however, been previously reduced to an exact thickness, and flattened, by a heated flat-iron applied to each, singly)—one of the cast-iron tools is heated in the manner before mentioned, applied to the cement on the backs of the lenses, and instantly cooled, as above directed. Great care must be taken, in placing the seven glasses in, or upon, the brass tool, to fix the best piece of glass in the centre, as that will form the most perfect lens; and also to see that no two of the other glasses are in contact, but are a little removed from each other. They are now ready for finishing the grinding.

On the Preparation of the Emery, by Washing Over.

The emery used for rough grinding in the cast-iron tools, is washed over, so as to separate it into six different degrees of fineness, in the following manner:—

It is put into a large earthen-ware vessel, which is nearly filled with water, and being stirred up, is left to repose for the space of one quarter of a minute, and is then poured off into another large vessel; and so on, in succession, according to the following periods, viz.—

No. 1. One quarter of a minute.
2. One minute.
3. Two minutes.
4. Six minutes.
5. Fifteen minutes.
6. Thirty minutes.

After having stood the proper time for each degree, the emery deposited in the large vessels is put into small earthen vessels, which are carefully covered over with paper caps, to guard against the entrance of dust; and are marked from No. 1, to 6.

Of the Stand and Handle for the Grinding-Tools.

A well-framed stand, of a proper height, and not too wide at its base, must be provided. This is to be firmly screwed to the floor of the work-shop. On its top a cast-iron block is to be affixed, having upon it a male screw, exactly similar to that upon the end of the lathe mandrel; and upon this, the female screw at the back of the brass tool is to be screwed. Into the female screw at the back of the cast-iron tool, a handle, made of *lignum vitæ*, or other hard wood —of the form of a bulb, or an oblate spheroid, of a convenient size to be readily grasped with the hand, and having a male-screw made to fit—is to be put. The tools will now be ready for work; and the operation must be performed in the following manner:—

On the Manner of Grinding in the Tools.

A little of the washed emery No. 1, mixed with water to a thick consistence, is to be taken out of the vessel with the fingers, and to be spread pretty uniformly over the surface of the brass grinding-tool. In order, however, still more to equalize it, and prevent it from lodging in lumps, a piece of glass which had been previously ground, of the same curvature as the tool, is to be worked in it; and the outer edge of the tool is also to be freed from the emery with a wet sponge. The block of lenses is then to be placed in or upon the brass tool, and the grinding proceeded with as follows:—The workman takes hold of the handle of the block with his right hand, and gives it a long oval movement across the tool, carrying it a little beyond its edge; and, every second stroke, giving the block a twist with his left hand; at the same time gradually walking round the stand, backwards and forwards alternately, so as to give every part of the tool an equal chance of wear. In case the block moves too stiffly, a little water should be sprinkled over the surface of the tool; and as soon as the emery is clogged with the glass, and ceases to cut, it must be wiped off, with the moistened sponge, both from the tool and the lenses; carefully observing that none is suffered to lodge in the spaces between the lenses. The next degree of the emery is then applied in the same manner; and so on, till each has done its office. No. 6, however, is to be applied twice, in order to bring the lenses to a better and finer surface for polishing. If, however, during the operation, any scratches are found to appear on the lenses, even when viewed with a magnifier, the operation of grinding must be repeated. Great care ought also to be taken to wash the sponge clean from the different sorts of emery during the process.

To Polish the Lenses.

A tool is to be heated and coated with cement; and for large lenses it must be lined with a thick woollen cloth, made on purpose; for smaller ones, with ordinary woollen cloth; and for still smaller, with kerseymere: either of these, as the case may require, is to be applied upon the heated cement, and then be worked in or upon the lenses affixed to the block, till it has assumed their curvature. The pores of the cloth are then to be filled up with No. 6, washed emery and water (or the finest sediment which will in time be formed in the tub, in which the sponge, after wiping the grinding-tools, is continually washed,) to bring it to a uniform surface; and when cooled, putty, or the combined oxides of tin and lead, is shook uniformly over it, from a tin box with a lid perforated with holes, and a little water is sprinkled upon it. The polishing then commences:—but the strokes are now made backwards and forwards directly across the tool, not in oval sweeps as before; and the other directions must be particularly attended to.

When both sides of the lenses have been ground and polished, in the manner described, they must be finished separately. This is termed *rectifying* them.

On Rectifying the Lenses.

In order to perform this operation, SMALL TOOLS must be cast of the following compound metal, viz.

Lead, one pound;
Regulus of antimony, eight ounces.

This composition admits of being readily turned in the lathe, with tools wetted with water.

In order to form the tools, a hole must be turned in a piece of wood, to the shape the tool is to be made of; namely, with a round, flat surface, large enough to hold the lens when cemented upon it, and with a stem at the back, to contain a female screw, which is to be cast in them thus: The mandrel of the lathe is to be placed in the middle of the hole made in the piece of wood, and the melted compound metal must be poured into the mould thus formed. When cold, the tool is to be finished in the lathe by turning it, and its flat face must be roughened by making scratches across it in every direction, the better to retain the cement upon it.

Of the Cement for Rectifying the Lenses.

Pitch, one pound;
Bees-wax, one ounce;

melted together, and strained through a cloth.

Two of these tools, being coated with this cement whilst it is warm, are to be applied successively to the wetted surfaces of the lens, so as to take its curvature or curvatures exactly: the cement must, however, previously have two gaps or furrows made through it, to the surface of the metal tool; and these must again be crossed by two others, for the extraneous polishing material to lodge on.

The lens will readily adhere to either of the surfaces formed of the cement, by merely breathing upon it, and can easily be removed again; which is absolutely necessary in this operation of rectifying it.

The polishing, or rectifying, is effected with the finest washed putty, applied upon one of the faces formed of the cement, whilst the lens is held upon the other: and the putty is put into a phial with water, and that only which remains suspended in the water, after being stirred up, is employed.

On Centring the Lenses.

This is effected by affixing the lens upon the end of the hollow mandrel of a lathe, coated with a ring of cement, whilst it is warm; and an object being placed before the lens, and a proper sight-hole provided at the opposite end of the mandrel, the mandrel is to be turned slowly round, and the lens shifted until the object appears steady when viewed through it. When the cement is cold, the lens is to be turned circular in the lathe, by applying a cutting diamond to it. [*Technical Repository.*

FRANKLIN INSTITUTE.

Report of the Committee of Premiums and Exhibitions, on the fourth Annual Exhibition.

The committee of premiums and exhibitions of the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, submit the following report, viz.

The fourth exhibition was held at the Masonic Hall, on Thursday, Friday, Saturday, and Monday, the 4th, 5th, 6th, and 8th inst. (October;) the committee of arrangement having deemed it expedient, from the unfavourable state of the weather, to defer the opening of the exhibition one day later than the time announced in the address to the public.

The committee have the satisfaction to report, that the display of American ingenuity and industry justifies the most sanguine anticipations of those who instituted these exhibitions. Every succeeding year brings before the public, articles of manufacture before unknown, which, in the intervening space, have advanced so rapidly, as to warrant the belief, that time and experience only, are requisite to place them beyond the reach of foreign competition. The advantages of these exhibitions thus successively present themselves in stronger characters; an honourable spirit of competition is apparent in the improvement manifestly created by them, and in the public patronage which they secure to the Institute. Notwithstanding the barrier interposed by your prudence to prevent an excessive crowd, by requiring a small fee for admission from those who are in no way contributors to the Institute, the rooms were at all times well filled, and frequently so crowded as to render repeated visits necessary in order to gratify the curiosity of many, to the extent of their wishes. Your committee, therefore, recommend the continuance of this salutary arrangement, so well calculated to promote the interests of the Institute, and at the same time to gratify those from whom the money is received.

Your committee have much cause to regret, that a disposition to procrastinate is still manifest among the contributors to the exhibition; and that it has prevented them from having the satisfaction of conferring many premiums, which the excellence of the articles, and the favourable opinions of the judges, would have awarded to them, had they been received at the time specified. They hope that the disappointment experienced by many from this cause, will induce them, hereafter, to apply the remedy which a little forethought will supply.

Your committee recommend that the friends of the Institute be invited to send communications to their secretary, A. G. Ralston, Esq., specifying any article which they may deem worthy of notice, and furnishing such information as they may possess, to aid them in framing the list of premiums for the next annual exhibition.

Your committee deprecate the prevalence of a feeling which has prevented many meritorious artizans from exhibiting specimens of their *ordinary merchantable manufactures;* it should be more generally understood, that the object of these exhibitions is not to promote the manufacture of any article, the cost of which would be an insuperable obstacle to its profitable sale, but of such, principally, as are extensively used.

Your committee cannot withhold the expression of their satisfaction for the liberality and candour, and, in general, for the prompt attention manifested by the various committees of judges, whose delicate task has been executed in such manner, as they confidently hope will obtain for them the favourable opinion of the public.

In announcing the premiums which have been awarded, the committee reserve to themselves the pleasure of giving, hereafter, a detailed list of all the articles exhibited, and of bestowing such commendation as their feelings would prompt, and the recommendation of the judges will justify.

Of the sixty-two premiums proposed by the managers of the Institute in their printed circular of the 24th of February last, the committee have awarded 15—as due by the terms of the prospectus, and eight honorary premiums for articles not enumerated.

REGULAR PREMIUMS AWARDED.

Premium No. 3.—"To the maker of the best *instruments for operations on the eye.*"

This premium is awarded to Messrs. Wiegand & Snowden, of Philadelphia, for a case of instruments, No. 12—adjudged remarkably excellent.—*A silver medal.*

No. 7.—"To the person, in the United States, who shall make the greatest quantity of *soda,* not less than five tons."

The premium is awarded to Messrs. M'Kim, Sims, & Co. of Baltimore, for specimen No. 329, being a sample taken from a lot of more than seven tons, manufactured from American materials. It is reported by the committee of judges to be a very superior article, and deserving of particular praise. This soda has been on hand during the late summer, by which its permanence under atmospheric changes was fairly tested—*A silver medal.*

No. 21.—"For the best specimen of the *cutting* of *flint glassware,* of which a variety of articles must be exhibited, and the excellence of form, as well as the quality of the material, will be considered in awarding this premium."

The specimens exhibited were numerous, from the manufactories of Messrs. Bakewell, Page, & Bakewell, of Pittsburgh; of Messrs. Jackson & Baggot, of New York; of the Union Glass Company of Kensington; of the New England Glass Company of Boston, and of Messrs. M'Cord and Shiner, of Philadelphia. They were, with few exceptions, of excellent workmanship, metal, and form, and evinced much improvement in the cutting; an art which has attained to such excellence in this country, that the importation is unnecessary. The premium is awarded to Messrs. M'Cord and Shiner, of Philadelphia; they having exhibited, in lot No. 341, the greatest quantity of articles of excellent workmanship—*A silver medal.*

No. 24.—"For the best specimen of *gig* or *coach harness*, made in Pennsylvania."

In this branch of manufactures, several beautiful specimens were exhibited from Amos Atkinson, Magee & Tabor, &c. of this city; the workmanship, as well as the materials, was generally of a superior character. The premium is awarded to Messrs. Magee & Tabor, for No. 231, being a splendid set of coach harness, in which the leather and workmanship were judged to be better than any other exhibited —*A silver medal.*

No. 25.—"To the maker of the best *buckskin gloves*, the leather to be dressed in the United States, and the gloves to be made in Pennsylvania."

The premium is awarded to Mr. Henry Lye, of Philadelphia, for No. 69, being six dozen pairs of gloves made, and the leather dressed, by himself. The workmanship was good, the leather fair, and that in the horseman's gloves very superior to any exhibited—*A silver medal.*

No. 29.—"For the best specimen of *lithography*, to be executed in the United States."

The premium is awarded to Rembrandt Peale, of Boston, for specimen No. 197, being his beautiful portrait of Washington, executed by him, and printed at the press of Messrs. Pendletons of Boston; esteemed the best specimen of American lithography ever seen by the committee on fine arts—*A silver medal.*

No. 31.—"To the pupil of the drawing school of the Institute, who shall make and exhibit, in October, 1827, the best *specimen of drawing.*"

Three specimens were exhibited: a perspective view of the Marine Asylum, Norfolk, by Mr. Campell, of New Jersey. Very correct, and the point of view chosen with taste. Canova's Venus, in oil, by Jefferson Garret; alike creditable to the instructer and the pupil. And a well executed Corinthian capital, by Andrew Young, of Manayunk. Mr. Young was the only competitor who fulfilled the conditions of the premium, and to him is awarded—*A silver medal.*

No. 34.—"To the maker of the best *cabinet book case* and *secretary.*"

The premium was awarded to Mr. Anthony Quervelle, of Philadelphia, for No. 250, being a splendid piece of furniture from the establishment of this excellent workman—*A silver medal.*

No. 36.—"For the best *upright* or *horizontal piano.*"

Pianos were presented by Mr. C. Pommer, Mr. Mickley, and Messrs. Loud & Brothers, of Philadelphia, and by Mr. A. Babcock, of Boston. All of which were finished in a manner highly creditable to the makers. The premium is awarded to Messrs. Loud & Brothers, for No. 33, an organized piano, combining the properties of a piano and organ, the latter having two stops, the flute and dulciana, each of a remarkably sweet tone. The piano, as a separate instrument, was strong, full, even, rich, and brilliant, in its tone—*A silver medal.*

No. 42.—"To the manufacturer of the best *flannel* made in Pennsylvania."

The premium is awarded to Mr. John Bancroft, of Delaware county, for eleven pieces of flannel (No. 28) remarkable for excellence in fabric, as well as for cheapness—*A silver medal.*

No. 48.—"To the manufacturer of the best specimen of *calicoes*, or *prints*, for ladies' dresses, made in the United States."

Various articles were presented from the Warren factory near Baltimore; from the Merrimack Company, Massachusetts, and Taunton factory, Massachusetts; all of which manifested much improvement in the art of printing. In the specimens from Warren, the colours were very excellent. The Merrimack undressed prints, were a superior article, and the colours good, but the Taunton goods were deemed the best, in considering the colours, fabric, and printing. The premium is consequently awarded to Messrs. Crocker, Richmond & Otis, of Taunton, Massachusetts, for No. 266—*A silver medal.*

No. 50.—"To the manufacturer of the best specimen of *heavy cotton goods*, fit for labourers' wear."

The premium is awarded to Mr. Hugh Dickson, of Philadelphia, for No. 53, being 21 pieces of drilling at 22 cents per yard; a good and substantial article—*A silver medal.*

No. 54.—"To the maker of the best *loom cotton stockings*."

The premium is awarded to Mr. George Tupman, of Philadelphia, for specimen No. 25, being five dozen pair, which will undoubtedly prove to be a strong and durable article—*A silver medal.*

No. 57.—"For the best specimen of *porcelain*, to be made in Pennsylvania, either plain white, or gilt."

This is a manufacture of great importance to the country, as most of the capital expended is for labour; the materials being taken from our soil, in great abundance and purity. The highest credit is due to Mr. Wm. E. Tucker, for the degree of perfection to which he has brought this valuable and difficult art. The samples (No. 174) of this ware, were made by him. The body of the ware appeared to be strong, and sufficiently well fired, the glaze generally very good, the gilding executed in a neat and workmanlike manner. Some of the cups and other articles bear a fair comparison with those imported —*A silver medal.*

No. 61.—For the best specimen of *edged tools*, ordinarily used by carpenters, &c. one dozen to be exhibited.

But one competitor appeared, which was Mr. Robert Beatty, of

Village Green, Chester county, Penn. whose tools sustained the high character they have always borne, being superior, in the estimation of the committee, to any similar articles of foreign manufacture with which they are acquainted. The premium is, therefore, conferred on Mr. Beatty.—*A silver medal.*

SPECIAL PREMIUMS.

Many well executed articles were exhibited, for which no premiums were offered; to these the Institute have reserved the right of awarding such honorary premium, or compliment, of which the object may be deemed worthy.

No. 1.—Two *cabinet pianos* were exhibited by Mr. Charles Pommer, of Philadelphia, the keys of one of them were of mother-of-pearl; they were both much, and justly, admired, particularly that made with ivory keys. They were considered inferior to none but the organized piano of Messrs. Loud & Brothers. The committee have, therefore, awarded to Mr. Charles Pommer, as an honorary premium—*A silver medal.*

No. 2.—A large assortment of *floor cloths* was exhibited by their enterprising manufacturer, Mr. I. M'Cauley, of Philadelphia. One piece attracted particular notice, containing 140 square yards, without seam. These cloths are equal to the best imported, and much cheaper. The committee awarded to Mr. M'Cauley—*A silver medal.*

No. 3.—A *map of South America*, by John L. Wilson, a pupil of the High School of the Franklin Institute, evinced much talent in this youthful draftsman; the committee have much pleasure in awarding him—*A silver medal.*

No. 4.—The committee witnessed with great pleasure the improvement, which has taken place in the manufacture of *straw goods.* And while they regret that Pennsylvania has not claimed the premiums No. 11 and 12, for straw plait, they cannot withhold their commendation for the praiseworthy exertions of their neighbours. The importance of the straw manufacture is great, because it employs females and children. The samples of straw bonnets were much superior to any that can be imported at the same price. Those from the Walnut-street school deserve particular praise, as they were made by children of 8 or 10 years of age. Ten assorted *Leghorns* by J. Beacher, Tioga county, New York, evinced much improvement. Some of the bonnets were of very fine texture, viz. No. 52, two *Straw Hats*, by Mary Wright, of Providence, and No. 21, by Mary Lincoln, Taunton, Massachusetts, all of which were beautiful specimens. The committee think the latter deserving of the first place, from the natural and uniform brilliancy of the straw, its freshness, and the evenness of the edge; and awarded to Mary Lincoln—*A silver medal.*

No. 5.—*Gilt Buttons* received from Mr. Richard Robinson & Co., Attleboro, Massachusetts, and deposited by Mr. F. S. Krug: were beautiful specimens of this manufacture, in all points equal, and in some, superior, to the imported. They deserve the highest commendation, and are deemed by the committee worthy of an honorary premium; they, therefore, award to Messrs. Richard Robinson & Co.—*A silver medal.*

No. 6.—To the New England Glass Company of Boston, great credit is due, for their splendid specimen of *Stained Glass*, which, in the opinion of the admirers of the Fine Arts, shows much skill, taste, and enterprise, and compares advantageously with similar modern productions, in countries where the arts have attained greater maturity. They deem an honorary premium due to this company, and, therefore, award them—*A silver medal.*

No. 7.—Two pieces of *Blue Cloth* at 5 dollars per yard, made by Messrs. Kershaw and Dean, of Pennsylvania, were deemed by the committee to be worthy of a premium, on account of the price, which is very low for the quality. It is not pretended that the cloth was equally fine with that exhibited last year, but it was much cheaper:—*A silver medal.*

No. 8.—Messrs. Yale & Co. of Wallingford, Connecticut, deserve much praise for their manufacture of *Block Tin Ware*, which has been carried by them to a state of great perfection; and has nearly superseded the use of Britannia Ware, to which it is in many points superior, as also much cheaper:—to them is awarded an honorary premium of—*A silver medal.*

ARTICLES TO WHICH HONORARY MENTION IS AWARDED.

No. 1.—The *horizontal piano* made by Mr. Joseph I. Mickley, Philadelphia, was entered as a specimen of a plain and cheap instrument, and is deserving of praise. Also a horizontal piano by Mr. A. Babcock, Boston, of an improved construction; the frame which supports the wires being of iron, and sufficiently strong to sustain their enormous tension. This instrument was finished in the best manner, not merely in the exterior, but throughout, and the maker has maintained the high character which he had previously acquired. The tone of this piano is not powerful or brilliant, but remarkable for its uniformity from the lowest to the highest note.

No. 2.—M. William J. Young, of Philadelphia, exhibited a *Spirit Level* and *Surveyor's Compass*, both instruments highly finished, very complete of their kind, and which may be advantageously compared with those imported.

No. 3.—The committee, and, indeed, the visitants generally, were struck with the great improvement that has taken place in the form and workmanship of *Coal Grates*, since the last exhibition. Specimens were sent by Mr. T. Pettit, Mr. S. P. Morris, and Messrs. N. Lloyd and Son, of Philadelphia. They all deserve great commendation, but the committee have expressed so great a diversity of opinion on their relative merits, that they have not felt justified in giving a preference to either of the competitors, but have determined to award to each an *honorary mention.*

No. 4.—Mr. N. Gevelot's *head of Minerva*, executed by him for the Philadelphia Arcade, in terra cotta, does much credit to the progress of the arts in this city. It is not only quite suited to its purpose, being of a very durable material, but evinces power in the artist to execute with success, works of a much higher character.

No. 5.—To Mr. H. S. Tanner, of Philadelphia, for his map *of Virginia*, which, in point of execution, is superior to any thing of the kind heretofore published in this country.

No. 6.—*Slaughter sole leather* was exhibited from the manufactories of Mr. John Ashburner, and Messrs. G. & J. Laws, of Philadelphia; they were both of the very best quality, and the committee of judges were unable to decide which ought to have the preference. The *dry hide sole leather* of Mr. Ashburner was superior to any hide leather exhibited.

Mr. George Wilson's very superior *oil dressed leather* and *parchment*, remarkable for the excellence of the material and workmanship, merit for him, as do the above articles for Mr. Ashburner and the Messrs. Laws, each an *honorary mention.*

No. 7.—Particular notice is due to Mr. John Elliot, of Philadelphia, for No. 62, a specimen of *Bi-carbonate of soda*, a handsome and perfectly saturated salt, containing 49-100 carbonic acid, mild to the taste, and perfectly white; it is the best exhibited.

No. 8.—Messrs. M'Kim, Sims, & Co. of Baltimore, exhibited No. 329, a specimen of *sulphate of magnesia*, which was quite free from iron. These gentlemen, with another manufacturer of Baltimore, have the merit of excluding the English salt from our market, and now furnish a much better article, on lower terms than when we depended on foreign supply.

No. 9.—Specimens of *white lead* were exhibited by Messrs. S. P. Wetherill & Co. and Mr. Samuel R. Wood, both good articles. That from Messrs. Wetherill's manufactory, was adjudged the best, and to them was awarded an *honorary mention.*

No. 10.—The *patent bedstead* of Mr. J. Aitkin, attracted much attention, the construction being peculiar from its having no screws, and being so contrived, that it can be securely put together, and readily taken apart in a very short time. The committee think this plan should be generally adopted.

THE FOLLOWING ARTICLES WERE DEEMED WORTHY OF PARTICULAR NOTICE.

For an admirable *map of Europe, and of the United States*, by Mr. Anthony Finley, of Philadelphia, much credit is due.

Specimens of *Lake and Carmine*, by Mr. Joseph Boston, of Philadelphia, were considered equal to the best imported colours.

A *case of water colours*, by Mr. George C. Osborne, is quite equal to that of last year; the lakes were of an improved quality.

The *green verditer*, by Mr. Thomas Harrison, was the best of the kind exhibited. The *rose pink, blue verditer*, and *Dutch pink*, from the manufactory of Messrs. Harrison and Halsey, of New York, were superior articles.

Paper hangings made by Mr. Andrew Humphreys, of Philadelphia, were of excellent quality, and deserve particular commendation.

Much credit is due to Mr. George Parkinson, for his excellent specimens of *preserved fruit.* They were put up with much skill, particularly the smaller fruits. The brandy fruits were much improved by age.

The committee cannot close this report, already extended much beyond their original design, without expressing their favourable opinion of several articles, upon whose merits the space allotted to them will not permit them to enlarge. Amongst these, are a pair of splendidly cut, *glass decanters*, from Messrs. Bakewell, Page and Bakewell, of Pittsburg. The *Atlantic Souvenir*, for 1828, which reflects the highest credit upon the liberal patronage bestowed upon the Fine Arts, by the enterprising publishers, Messrs. Carey, Lea and Carey. A splendid *side board* and *French secretary*, from Mr. C. P. White. A beautiful and highly finished *flute*, by Mr. Catlin. A pair of *cotton blankets*, from the Eagle Factory, Trenton, and some handsome *dimities*, from the Hamilton manufactory, at Lowell, Massachusetts.

Some articles of great merit are not mentioned in this report, as they were brought into the exhibition after the lists were handed to the judges; and the committee are apprehensive, that others may have been overlooked, for which, they must beg the indulgence of the depositors, it being almost impossible to avoid doing injustice to some, in so extended a catalogue. Should any one feel himself aggrieved, the committee hope that they may have an opportunity of repairing their fault in the detailed report of the exhibition, which will be published as soon as it can be prepared.

Signed JAMES RONALDSON,
THOMAS FLETCHER,
ADAM RAMAGE,
ABRAHAM MILLER,
SAML. J. ROBBINS,
A. G. RALSTON,
} Committee.

Philadelphia, October 18*th*, 1827.

On washing Emery for Optical purposes, &c. *By* M. CHEZY.

IN order to obtain *very fine emery*, and of different degrees of fineness, the sieve is not sufficient, but water must be used. After having well ground the coarse emery on an iron plate, with a muller of the same metal, it is thrown into a vessel, which must be rather wider at bottom than at top, by a gradual increase. The vessel must then be filled with clear water, so that it may stand eight or ten inches above the emery. The whole is then to be strongly agitated with an iron spatula; after which it must be left to settle for an hour. The emery falls to the bottom, but the water remains turbid, being charged with emery, in the state of an extremely fine and light matter. The shortest leg of a syphon, filled with clear water, must be plunged to the depth of four inches below the surface of the emery water; holding the other extremity of the syphon closed with the finger, which is afterwards to be withdrawn, that the water may flow through the syphon, without stirring the vessel, or agitating the emery which is at the bottom of it. The water thus drawn off is to be received into another large vessel, and the first vessel is to be again filled, and its contents agitated as before. The same operation is to be repeated till the water passes clear through the syphon. The powder which passed over with the water, and which was received in the second vessel, is too fine to be usefully employed in grinding glass. The vessel being emptied and cleared, the same operations are to be repeated, with this difference only, that instead of leaving the water to settle for an hour, no longer time is employed than half an hour; and when the water passes clear through the syphon, the operation is discontinued, and the emery obtained by subsidence from the water, and carefully defended from all impurities, is reserved under the denomination of "*emery of half an hour.*"

The same operation being repeated, allowing only a quarter of an hour for the subsidence, affords an emery, which is, indeed, fine, but less so than the preceding, and is to be reserved under the denomination of "*emery of a quarter of an hour.*"

By similar processes, emery may be obtained, of half a quarter of an hour; or of any other length of time which may be desired, as of four, of two, of one, of one half, or one quarter of a minute. To measure the half or quarter of a minute, a pendulum beating seconds (or a weight suspended by a string of 39,2 English inches) may be used. The oscillations are to be counted from the moment of the ceasing of the agitation; and, at the instant of the thirtieth or fifteenth oscillation, the finger being withdrawn from the mouth of the syphon, previously placed in the water, suffers this fluid to flow. The sieve may be used for coarser emery.

Observations by Mr. Gill.

We have extracted this article from Nicholson's quarto journal of Natural Philosophy, vol. III. It forms a useful addition to the information we have given in the article, p. 398, on Mr. Blore's (a late workman of Mr. Tulley's) method of washing over emery. We do not think, however, that the finest emery would be of no use in grinding glass; on the contrary, we have found that the glass *greyed* by *the finest emery we could produce*, and applied upon lead, is the best to be employed in the microscope, for removing the false glare produced by the sun's light, or the light of a candle or lamp.

It would be convenient to mount the syphon in a hole made in a flat piece of wood, at the proper height, to reach four inches down below the surface of the water; when the board was laid upon the top of the vessel, the trouble of supporting it at the proper height by the hand, would be thus saved. [*Technological Repository.*

Plan for preserving the Walls of New Buildings from Dampness.

The author considers the introduction of moisture into buildings, as the effect of a capillary attraction. The less time (says he) is taken to finish buildings, the more rapidly does the water penetrate, because when they are not yet dry, they more easily conform themselves to the humidity of the soil which supports them, and the evil is more or less rapid, in proportion as the earth contains more or less nitre or other salts; and even the most impenetrable cements, hitherto employed, cannot prevent, at all points, the ascension of water through the medium of capillary tubes. It would be desirable to cover the whole thickness of the wall, at about two feet from the earth, with an impenetrable substance, and to preserve likewise the lower part of the building from the dampness of the soil.

The most certain method of doing this, would be by means of a layer of sheets of lead, about a line thick, soldered together. If, notwithstanding the absence of air, the oxidation of this metal were apprehended, and the consequent penetration of dampness through the pores of the oxide, recourse might be had to another method, less expensive, and which would equally well answer the proposed end. That is, to spread over the whole thickness of the wall, a layer of pit coal, mingled with pitch or rosin, and powdered charcoal. This material, being soft, would, when loaded with the weight of the building, fill up all the vacuities, and prevent the access of moisture most effectually. [*Bull. des Sciences.*

Lukens's Chronometer Springs.

Mr. Isaiah Lukens, of this city, has invented a mode of hardening the balance springs of chronometers, in a very superior and perfect manner. In the operation of hardening, by the improved process, the polished spring loses scarcely any of its brilliancy; the helical figure is perfectly preserved, and the grain of the steel is evidently less liable to injury than by the old method. The complete protection of the surface, is, indeed, an assurance, that the interior is also preserved from deterioration.

The Editor has been confidentially made acquainted with the process followed by Mr. Lukens, and is not, therefore, at liberty to publish it. Several of the most eminent chronometer makers in England, have adopted it, and have cheerfully rewarded Mr. Lukens for his ingenious discovery, and others will undoubtedly avail themselves of its advantages.

Mr. Gill, who is Mr. Lukens's agent in London, has received the subjoined certificates, which he has published in his Technological Repository.

Royal Exchange, London, Aug. 23, 1827.

Sir—I am happy to bear testimony to the excellence of Mr.

Lukens's new method of hardening steel balance springs for chronometers.

The difficulty of preserving the pristine excellence of the steel will be conquered; and although the result can only be ascertained by a sufficient trial, through the various adjustments, yet I have the strongest impressions on my mind, that it will be crowned with success.—I have the pleasure to subscribe myself, sir, your humble servant,

John R. Arnold.

1, *Change Alley, London, Aug.* 20, 1827.

Sir—With respect to the process of Mr. Lukens, for hardening chronometer springs, as exhibited to us, its superiority is unquestionable. Whether it may be productive of any other advantage, will require both time and observation to determine.—We are, sir, your obedient servants,

Parkinson & Frodsham.

6, *East street, Red Lion Square, London, Aug.* 25, 1827.

Sir—The best proof I can give of the efficacy of Mr. Lukens's method of hardening pendulum springs for chronometers, is, that I do not intend, for the future, to adopt any other. I have made several, and find them to answer completely according to my wishes.—I remain, sir, your obedient servant,

R. Widenham.*

31, *Great Ormond Street, Queen's Square, London, Aug.* 24, 1827.

Sir—The mode of hardening chronometer pendulum springs, communicated to me by Mr. Lukens, I consider superior to any I have seen, and another step towards the perfection of these instruments.—I am, sir, your obedient servant,

J. Green.

We are much gratified in being able to announce that Mr. Lukens has determined to commence, in Philadelphia, the manufacturing, repairing, and regulating of chronometers; he has, for this purpose, made arrangements with the principal manufacturers in England, which will secure a supply of the best materials of the kind which it may be necessary to import. Those who are acquainted with his skill as a workman, will have the most perfect confidence in his ability to carry his intentions into successful operation. His visit to Europe will thus have secured to his country the honour and advantage of obtaining, at home, instruments of the highest value in a nautical point of view, and which also furnish a most triumphant example of human ingenuity and skill; may the success of the individual equal the importance of the undertaking.

Editor.

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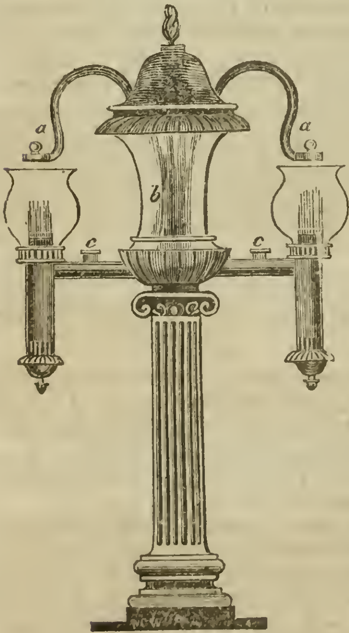
* Mr. Widenham gained the premium of 300*l.* assigned by the Lords of the Admiralty, for the best chronometer, after one year's trial at the Royal Observatory, Greenwich, in the year 1825.

Hon. E. Cochrane's *Patent Dissolvent Lamps.*

The object of the invention appears to be, to render fluid, tallow, cocoa nut oil, (otherwise butter of cocoa,) and all other concrete oils, or fat, by conducting a considerable portion of the heat given out by the flame of the lamp into the tallow, &c. thus liquifying them, and causing them to flow, to the wick of the lamp, to be consumed like the naturally fluid oils. When tallow, or kitchen fat, is thus employed, the combustion is so perfect that a very rich and brilliant light is given out, unattended with the emission of any unpleasant odour or smoke.



a a are two solid bent metal rods that conduct the heat, received from the flame of the lamp, to the tallow contained in the reservoir *b*; the ends of these conductors are therefore made to descend to the bottom of the reservoir. *c c* are two apertures (with covers that screw on) made in the supply pipe, for the purpose of pouring in a small quantity of melted tallow upon lighting the lamp, after which, the heat from the combustion is conducted into the reservoir, and the supply of fluid tallow is uniformly kept up until it is all consumed.

From the circular given to us by the agent, on the occasion of our calling at his shop, we extract the following observations on the advantages attending the use of these lamps.

"To those acquainted with the superior combustible properties of *Tallow* and *Cocoa Nut Oil*, it is unnecessary to say more than that *these lamps effectually melt and burn*, *both*, and that the price of the latter, at the manufactory, is 2*s.* 6*d.* per gallon! but to others, to whom their good qualities are less known, it is necessary to state, that from the comparatively small portion of oxygen necessary to complete their combustion, the *total absence of smoke and smell is insured*, and the brilliancy of the flame is such as no lamp ever before produced, and nothing but the best gas light can equal.

"To families who kill their own meat, to inn-keepers, proprietors of cook shops, &c. a two-fold advantage will be found in the use of these lamps, as it is *not merely tallow that they burn*, *but grease of* *every description*, such as *dripping, pot skimmings, &c.* a pound of which, value about 3*d.* will continue, for full twelve hours, in a common-sized dissolvent argand burner, to yield light *equal to eight candles*, being no more than a farthing an hour!"

[*Register of the Arts.*

New Invented Crane.

In the October number of Newton's Journal, he has given the subjoined account of a new invented crane. We shall, hereafter, obtain further particulars of its construction, and we greatly err in our judgment, if its operation will be found to justify the expectations which the present publication is calculated to excite. We may find an improved instrument, in which the power is more conveniently applied, than in those heretofore made, the friction may be lessened, and the obstruction from the rigidity of cords, or other causes, may be, in some measure, obviated; but should the effective power of men be increased, in the ratio represented, we must obtain some new mechanical power, acting upon new 'laws of nature;' perpetual motion will no longer be an impossible problem, and we shall 'be condemned to study again our experimental philosophy,' and rearrange all the machinery operated upon by the power of men. The following is Mr. Newton's account. [*Editor.*

"Mr. L. W. Wright, has just completed a crane for raising heavy bodies, which is constructed upon very different principles to any crane that we have before heard of. It is without either wheel or pinion, and acts by an extremely simple adaptation of wedges and levers. There is one extraordinary property, in this peculiar combination of mechanical powers, which appears to shake the validity of an old established axiom, that "power can only be increased at the expense of velocity," for this crane does actually raise heavy weights with less than half the power of the best constructed cranes heretofore used, and with the same, or even greater velocity.

"Mechanics have considered a certain general rule of power compared to velocity, to be established, which, if we are not mistaken, is, that *two men will raise 600 cwt. at the rate of ten feet per minute*, by any of the known simple combinations of the wheel and pinion, or other mechanical powers; or, in other words, that one man will constantly exert a power equal to 35lb. during the hours of daily labour, which, being multiplied by ten, the assumed power gained by the machinery, and allowing 1-7th for the friction, leaves about 300 cwt. per man; and in all cases where the machinery is so constructed as to increase the effect of the power exerted to raise the heavy body, the velocity, or space through which the heavy body moves, must, accordingly, diminish.

"Several of these cranes have been lately erected at the West India Docks, and it has been proved, that, while two men raise, (as above said,) 600 cwt. at the rate of ten feet per minute, by the ordinary cranes, two men, with the improved crane, will raise more than 1500 cwt. through the same distance, in a similar space of time.

"The application of the mechanical principles, on which this crane is constructed, is admitted, by all who have seen it, to be perfectly new, and its performance, in every respect, satisfactory. We are not at liberty to describe its construction, at present, as the patents for Scotland, Ireland, and other countries, are not yet complete, nor is the specification of the English patent, yet inrolled; but, as soon as the invention can safely be made public, we shall lay it before our readers."

Perkins's *Steam Engine.*

Mr. Perkins's engine, erected at St. Catherine's Dock, has been, occasionally, at work, raising water, since our last notice, and, as we are informed, with all the effect desired. Mr. P. has now erected at his new factory, near Regent Square, Gray's Inn Road, a very complete engine, having two single stroke cylinders, connected together, both worked with high pressure steam.

The steam is admitted from the generator, through a very small induction aperture, at the lower part of the first cylinder, (which is a small one,) at a pressure, it is stated, of about one hundred atmospheres, and, when the piston has been forced up one eighth of its stroke, the induction aperture is closed. This volume of steam now expanding, drives the piston to the top of the cylinder, where an enlargement of the cylinder allows the steam to escape past the piston, and through a passage to the upper part of the larger cylinder, connected to it, where, acting with a diminished force, (say about ten atmospheres,) it drives the larger piston, to the bottom of its cylinder, and there escapes.

The two piston rods, being connected together, and the steam entering the two cylinders, at opposite ends, the two pistons mutually assist each other, in their ascent and descent; that is, the ascent of the smaller piston, lifts the larger one, and then the steam of diminished force, acting alike on the top of both pistons, forces them down; the induction aperture being now opened again, a volume of steam is admitted, as before, and thus the engine is continued in action, without any re-action of either of the pistons.

The specification of the last improvements, having been inrolled within a few days only, we have not been able to prepare the plates and description, but intend, at a very early period, to lay the subject fully before our readers.

[*Newton's Journal for Oct.*

On the Preparation of a Cheap and Durable Cement, or Stucco. By M. Lassaigne.

The writer observes, that the cement or plaster, commonly used in France, (which consists of a mixture of chalk, and strong size) is objectionable, as being deficient in hardness, apt to chip or scale off, and unable to resist the rain. He proceeds to state, that a composition formed of slacked lime, mixed with 4 to 5-100 parts of alum, though dearer than the former, has been found preferable, on account of its adhering more firmly to the wall, and being better calculated to resist the inclemencies of the weather, which, he conceives, is owing to the alumine of the alum becoming incorporated with the lime.

Following the advice of M. Dulong, he has endeavoured to imitate this cement, on a more economical principle. To effect this, he has diluted slacked lime and white clay, with water, and after mixing, suffered them to blend together, and re-act upon each other for some time, at an ordinary degree of temperature. The proportions of the separate ingredients are 100 parts of quick lime, five of white clay, and two of yellow-ochre. The process is as follows:

The lime is first slacked with a small quantity of water, more of which is added by degrees, until the mixture is reduced to about the consistence of cream, the white clay is also diluted, and brought to a similar state, by being suffered to remain for some time in water, and the two solutions are then mixed carefully together.

This mixture is suffered to remain in casks, or tubs, for about twenty-four hours, care being taken to stir it from time to time. After the expiration of this period, the yellow-ochre is added, as a colouring, and it is then fit for use.

The parts of walls covered with this cement, which have been exposed, in the country, to the influence of the south west winds, and rain, for the space of two years, have lost none of their colour, nor can any portion of the plaster be rubbed off by the hands.

[*Bull. des Sciences.*

New mode of Copying Oil Paintings, by means of Lithography.

M. Senefelder, of Munich, the well known lithographic artist, has invented a new process of printing coloured designs, so as perfectly to resemble oil paintings. The plate from which the impression is taken, resembles a species of mosaick, composed of different colours, in a soft state. The basis of these colours, consists of wax and oil, which are, probably, rendered soluble, by means of caustic potash. To obtain 100 copies, it is necessary that this stratum of colours should be, at least, a line in thickness; for a thousand, one inch, and for any other number, in proportion.

The inventor assures us, that the composition of the plate, does not occupy more time than a common oil painting on canvass. No particular talent is requisite, for the drawing. The process of the impression is, also, attended with but little difficulty. The paper, after being moistened, is laid upon the plate, and, by means of a slight pressure, a most beautiful copy is obtained, which is then carefully spread out upon canvass, covered with a strong drying varnish. The picture is, afterwards, washed over with alum water, in order to render its colours as durable as those of paintings in oil.

[*ib.*

THE ARTISAN.—No. 4.

Remarks upon Pumps for raising Water. By the EDITOR.

WE have, at different times, received communications, on the construction of pumps, and other machines for raising water, which have often served to manifest a deficiency in, or a total want of knowledge of their action. Among the numerous errors which prevail upon this subject, the idea, that the pressure of the atmosphere, diminishes the power necessary to raise water in the common pump, appears to be the most general. We have now before us, a letter received from a gentleman, in South Carolina, some weeks since, whose plan is, to raise water from deep wells, say, of 90 feet, by successive pumps. He proposes, that a pump of 30 feet in length, shall be placed at the bottom of the well, to raise the water into a reservoir, fixed to receive it, near the head of this pump; that the bottom of a second pump shall stand in this receiver, and that a third be similarly arranged, to elevate the water to the surface of the ground; and that the rods, from these pumps, be of sufficient length, to be attached to a common handle, at the top, to work them simultaneously. Three pumps, so arranged, will, he calculates, save, at least, the necessity of lifting a column of water, of three times 28, or 84 feet in length, and that the labour, therefore, would be so reduced, that the weight of the rods, the friction, and a column of water, of 6 feet in height, would, alone, require to be raised.

This may serve as a fair sample of numerous proposed improvements, coming, in many instances, from persons, not deficient in general intelligence; the subject is, therefore, worthy of particular attention, as such errors frequently lead to much loss, both in time and money. We will, hereafter, endeavour to place it in a clear light, but, at present, shall only state such facts and principles, as we think can be made plain to every attentive reader.

To the correspondent alluded to, we will say, that his plan, although novel to him, is not so to those conversant with the subject. Pumps made in the way proposed, have been constructed, and are figured in the books. To all those who imagine, that in pumping water, they can derive any aid from atmospheric pressure, we will say, that they are altogether heterodox. We cannot, by any conjuration, or by any cunning construction of our machinery, raise a hundred weight of water, to the height of ten feet, without the application of as much power as is requisite to raise a stone of the same weight, to the same height; *the atmosphere* will assist us just as little, in one case, as in the other; and, if we wish to raise double the quantity to the same height, or the same quantity to double the height, we must employ double the power, or, its equivalent, double the time.

The three pumps, made, as above stated, were so made, not to lessen the power required to raise the water, but to obviate some practical difficulties. A pump tree, of wood, ninety, or a hundred feet in length, is very liable to burst, by the weight of the column of water contained in it; and, from a similar cause, the valves are raised with difficulty: by dividing the pump into three parts, there will be a corresponding diminution, in this pressure; but, there will also be a greatly increased load, from the amount of pump rod; and, also, an increased number of valves, to open, and to become deranged. We did not, however, set out to discuss the merit of this kind of pump, or of any other, but to furnish some hydraulical didactics.

Something may, undoubtedly, be accomplished, in the improvement of pumps; but, we are just as well prepared to credit the accounts of the discovery of perpetual motion, as those which are so frequently given, of hydraulic machines, enabling two or three men to perform as much work, as double that number, by the machinery now known. It is, certainly, not possible to procure, with the same power, one-third more water than we now can, with our best pumps. Nearly, or quite, all that is to be hoped for, is to lessen friction, to remove obstructions to the free passage of the water through the valves, and to cause them to open and close, without loss of time, or of water.

With regard to the action of the atmosphere, we will merely remark, that we sometimes, and, indeed, generally, construct our pumps so as to bring it into operation; but, such is the nature of the aid which we derive from it, that, for every pound of water which it forces up by its pressure, we must force a pound of air, to the same height; and, if we choose to lengthen our pump rod, so as to allow the piston to be below the surface of the water in the well, we may dismiss the atmosphere from our service; and, were it not for the necessity of breathing whilst we are pumping, we should not, by so doing, lessen the facility with which water would be obtained.

Queries and Replies, respecting the Rise of Water, in certain situations.

The subjoined queries and replies, appeared in the National Gazette, of this city, a few weeks since, and perhaps our readers may not think them unworthy of preservation, in our pages. Who cracked the nuts, is a question which we might answer, but this is a point of little importance, provided they be well cracked; and that they are so, is the opinion of some, who are able to judge in such nice cases.
Editor.

A Nut for the Philosophers.

The water, in the lower part of the city of New Brunswick, is what is commonly called *brackish water;* it is unpleasant to the taste, and, in the opinion of some, injurious to health. This has induced a few gentlemen in that part of the city, to seek for a more pure supply, by the modern practice of *boring for water.* They selected their spot, perforated the earth, to the depth of two hundred and twenty feet, and then inserted, in the perforation, a tube of one hundred feet in length, reaching down to a body of solid rock, called the *red shell rock.* The upper end of the tube is inclosed in a wooden pent-stock, from which there issues a continual stream of water, of (I should think, without having measured it) from half a gallon to a gallon, by the minute.

The tide regularly ebbs and flows, in the Raritan, and rises at this place, about six feet, and the surface of the ground, where the perforation is made, is elevated about eight feet above the high water mark. In this situation, the stream issuing from the pent-stock, corresponds exactly, and continually, with the rising and falling of the tide, in the Raritan. When the tide is at ebb, the stream is small; when it rises, the stream increases, and, when it is high, the stream is at its greatest flow, varying, as about one to three, at the different states of the tide.

Now, the rising of the water, in the tube, is, itself, a phenomenon, not easily explained, upon the known principles of hydraulics. Can it come from the river, when the point of discharge is from eight to fourteen feet above the surface of the water, in the river? And, if it should be attempted to account for it, by supposing that it is conducted from higher grounds, by dipping strata of rock, or clay, or other substance impervious to water, and that, when such strata are perforated, at any given depth, the water pent up between them, will rise as high as its surface, in that confined state; does not this exclude the possibility of its having any communication with the river, or being in any way affected by it?

The fact is, as above stated. Can it be accounted for, upon any settled principle of philosophy? If water can be had by boring, in all situations, it is one of the greatest discoveries in modern times; and, if it has a tide in the bowels of the earth, it presents a phenomenon, unknown to philosophers, both of ancient and modern times.

X.

Soft-Shelled Almonds.

Without claiming the character of a philosopher, excepting in the original acceptation of the term, I will attempt to crack the nut held out to the fraternity, in the Gazette of the 12th instant, in the article headed *A Nut for the Philosophers.*

The theory, or, rather, the assumption, that water may be obtained, and made to flow above the surface, in all situations, is, I presume, intended to be sustained by the facts adduced by X. respecting the flow of water, through a tube, elevated eight feet above the Raritan, at Brunswick, in New Jersey; much stronger facts than those stated, will, however, be necessary, before the received theory will require additional support.

We are told, that the rising of the water in the tube, is a phenomenon not easily explained, upon the known principles of hydraulics; I think differently, and, at all events, do not expect to obtain a clear explanation upon *unknown* principles. That the water may be conducted from a higher situation, under "dipping strata of rock, or of clay," appears to be admitted, as, also, that, under such a state of things, by perforating the confining stratum, a flow of water would be obtained; but, in the case in question, we are told, that the flow of water from the tube, corresponds with the rise and fall of the tide, in the river, increasing in quantity, as it rises, and decreasing as it falls: and this, we suppose, is the nut to be cracked. We are asked, whether the admission, that the water, flowing through the tube, is derived from a higher source, does not exclude the possibility of its having any communication with the river, or being, in any way, affected by it? It is my design to answer this question in the negative, and to show that its connexion with the river, is, probably, the cause of the phenomenon.

If water, from any source, be conducted through a tube, into the bottom of an empty reservoir, it will flow with a velocity proportioned to the height of the source; but, as the reservoir fills, the column of water, as it rises above the orifice, will press upon it, and retard the discharge, and that, in exact proportion to its elevation. Were water allowed to flow through a small opening in the tube, above the top of the reservoir, the escape through this second opening, would be accelerated, as the water increased in the reservoir, and retarded, as it was diminished. Now, suppose the vein of water which was reached in boring, to make its final exit, in the bed of the river; the arrangement would be precisely similar to that which I have supposed, and the difference, in the quantity discharged, would necessarily result from the rise and fall of the tide. J.

On the rise of Water on the Kenhawa.

Observing, in the Gazette of the 12th instant, an article headed, "A Nut for the Philosophers," giving a description of the result of the procuring of water, in the city of New Brunswick, by boring, and the influence it is supposed the tide has, on the running of the fountain,—the writer of this, would beg leave to offer, to the philosophers, a nut quite as difficult to crack, if not more so. On the margin of the Kenhawa river, there are many borings for salt-water. The plan of obtaining it, is, by sinking a hollow sycamore, cut to a length so as to reach above high water, when placed on end, so as to exclude the fresh water; the boring being completed, a tube is inserted, the salt-water rises to precisely the level of the surface of the water in the river, and continues so: should the river rise to thirty feet, and sink to three, the salt water is equal with its surface, without variation. A SUBSCRIBER.

A Nut from the Kenhawa.

Having, on attempting to crack the nut from the Raritan, found it to yield easily to teeth, which are, themselves, of a brittle texture, I have determined to essay the Kenhawa nut, although *A Subscriber* appears apprehensive, that it may be found harder than the former; let those who are judges in such matters, examine, and tell whether I have not penetrated the shell, and exposed the kernel.

Admitting the phenomenon of the rise of salt-water, through a bored trunk, on the margin of the river, to be as stated, that is, that it will always rise to the level of the water in the river—however that level may vary,—it would follow, that the beds of the rock-salt, from which the springs are supplied, derive the water, by which their solution is effected, through fissures from the bed of the river. Under such an arrangement, the water would always rise to the height of the source whence it was derived.

Although I have attempted this second nut, I beg leave to state, that I do not intend to undertake the business of nut-cracker, to the community; I have now some on hand, which have resisted all my efforts, and shall be happy to obtain assistance from some one, whose *masseters* are stronger than my own. J.

Notice of some recent Improvements and Discoveries.

Extract from a letter from a person in Great Britain, dated September 30, 1827, to a gentleman of this city.*

"You have probably heard of Mr. Herschel and Mr. Blairs' invention of *fluid object glasses*, or fluids to be used instead of object glasses, in achromatic telescopes. The difficulty of finding a fluid that continued perfectly homogeneous, and some other difficulties about corroding the glass, prevented the perfecting of this suggestion for a considerable time; but at last, a telescope has been perfected on this principle, by Mr. Barrow, of Woolwich. His invention, is the use of sulphate of carbon for the purpose; and further, he has found means which Herschel could not fully explain to me, of diminishing, by one-half, the focal length.

Another suggestion of Herschel's, will probably lead to a great result. He long since imagined, that air, or other gases, compressed, might be used in steam engines instead of steam, which with increased power, might require less room and less fuel in the production and support. An engine has been constructed for an experiment, by some gentlemen of Edinburgh, with compressed air for the power. It was expected to do the work of a 30 horse power engine, but does the work of only 20 horses. The constructor thinks he sees the defect in the machinery, which occasions the loss of power, and that he can remedy it. If so—and if . . . . (several *ifs*, which Herschel stated to me, which I have not time here to repeat in detail,) it will be a great improvement, with amazing consequences."

"Dr. Brewster has copied for me, in his last letter, a passage from a letter he has lately received from a friend in Calcutta. Stating the extraordinary fact, that in our new territories, there is a plant, from whose stem, when divided, there issues a copious vegetable spring 'of limpid and wholesome water. The natives know this wonder quite well, and in consequence, you rarely meet with an entire plant. The shrub in question, is to us new, and a non-descript.' "

" 'The above is an extract,' says Dr. Brewster, 'from a letter of Dr. Wallick's, an eminent botanist, and the fact is undoubted.' "

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* The subjects noticed, have reached us in the Journals recently received from England, and may hereafter be presented to our readers more in detail.

List of Patents granted in the United States, from September 14*th to October* 25*th*, 1826.

By the attention of S. A. Elliot, Esq. of the Patent office, we are enabled to complete our list of American Patents in those parts which were defective, and shall, in the succeeding numbers, bring them up to the present period. The circumstances which have prevented their regular insertion, were stated in page 429 of our third volume.

FOR INVENTIONS AND IMPROVEMENTS.

In the printing press, called the New England printing press; Edward Cooper, Richmond, Virginia, Sept. 14th, 1826.

In the mode of sawing circular timber, or work for felloes of carriages; Benjamin Overman, Greensboro', North Carolina, Sept. 15th.

In the wheels for propelling steam boats, and for other uses; John James Giraud, Baltimore, Sep. 15th.

In rail-ways, called the portable endless rail-way; Jeremiah Price, New-York, Sep. 15th.

In the machine for manufacturing wrought nails, spikes, &c.; Joseph Krauser, Philadelphia, Sep. 23.

In the engine for throwing water for the extinguishment of fires; George Shalk and William Tintoff, Lebanon, Pa., Sep. 23.

In the wool-carding machine; James H. Arnold, Belmont, Ohio, Sep. 25.

In the machine for raising earth, mud, &c.; called the sub-marine excavator; Samuel Collins, New-York, Sep. 26.

In the mode of applying anthracite coal to the generating of steam; Daniel Collings and James D. Gallup, Wilkesbarre, Luzerne county, Pa., Oct. 12.

In the grist mill; Moses Mendenhall, Greensboro', Guilford county, N. Carolina, Oct. 20.

In bells; Henry Tyler, Utica, New-York, Oct. 20.

In the method of drawing water from wells, patented by him on the 2d day of Nov. 1823; Elijah Willard, Egremont, Mass. Oct. 23.

In making and constructing cellars, vaults, and magazines, in such manner as to prevent the tide or spring-water from entering in any way; Henry Hallack, New-York, Oct. 24.

In the manufacture of bridles; Daniel H. Read, New-York, Oct. 24.

In the machine for shelling corn; Elijah Russell, Greensboro', N. Carolina, Oct. 24.

In the horse saw-mill; Solomon R. Johnson, New-York, Oct. 25.

In the method of discharging cannon and ship guns; Henry Whitcomb, Adams, Jefferson county, New-York, Oct. 25.

In the bark-mill; Cotton Foss, Madison, Ohio, Oct. 25.

Patents granted in 1827, *from January* 3*d to February* 15*th.*

In rolling iron; Abraham S. Valentine, Bellefont, Centre county, Penn., Jan. 3.

In the water gate for penstocks, or flumes for mills; Henry Potes, Christiansburg, Montgomery county, Virginia, Jan. 9.

In making hoes, by rolling out cast or any other steel; Chauncey Bulkley, Colchester, Connecticut, Jan. 10.

In making irons for planes; and jointers, double and single, and of all sizes and shapes, by rolling together the steel; Charles E. West, Colchester, Connecticut, Jan. 10.

In the water-proof mortar or cement, stated by him to be from a mineral, not known or used for that purpose before his application; his former patent on this subject, dated on the 11th of January, 1826, being cancelled on account of an incorrect specification; Simeon Guilford, Washington, D. C. Jan. 16.

In the grist mill; Anthony Bencine, Caswell county, N. Carolina, Jan. 16.

In the plough for planting corn, &c.; Hermon Russell, Litchfield, Lincoln county, Maine, Jan. 16.

In the construction of stills, for the distillation of rum, whiskey, essences, and other spirituous liquors and cordials; Edmund Capen, Boston, Mass. Jan. 17.

Of a machine, called the bearded chisel mortising machine; Silas Metcalf, Wilmington, Vermont, Jan. 17.

In economizing the charring of wood, and the more effectual procuring of inflammable gas for working pneumatic gas engines, and other useful purposes, by a new combination of apparatus or machinery; Samuel I. Jones, Philadelphia, Jan. 17.

In the method of heating ovens, rooms, &c.; Michael B. Portiaux, Richmond, Va. Jan. 17.

In the mode of making pipes, tubes and gutters, of all kinds, for the conveyance of water, above or below the surface of the earth, from clay or argillaceous earth, by machines and various operations; Joseph Putman, Salem, Mass. Jan. 17.

In the grist mill; William Benbow, Guilford county, N. C., Jan. 19.

In the mode of generating steam; Levi Silliman, Albany, New York, Jan. 19.

In stirrup irons; Daniel Powles, Baltimore, Jan. 26.

In bedstead joints and sacking bottoms; Daniel Powles, Baltimore, Jan. 26.

In the press for tobacco, cotton, and other purposes; Benjamin R. Curtis, Richmond, Va., Jan. 29.

In the machine for planking hats; Robert Bacon, Boston, Jan. 31.

In the machine for tonguing and jointing boards; Elijah B. Clark, Damascus, Penn. Jan. 31.

In the lamp apparatus, for heating and boiling water, and other economical purposes; Thomas Green Fessenden, Boston, Jan. 31.

In the principles of machines for navigation; John James Giraud, Baltimore, Jan. 31.

In pumps, called "the Mariner's Friend;" James Robinson and Luke Shaw, Bath, Maine, Feb. 1.

In the construction of pedestal feet for andirons; Edmund Smylie, New-York, Feb. 1.

In the gun-lock; Simon Cromwell, Edgecomb, Maine, Feb. 3.

In the grist mill; Edward Newnam, Guilford county, N. C. Feb. 6.

In the machine for cutting straw; Thomas Benbow, Guilford county, N. C. Feb. 6.

In the horizontal wind wheel or wind mill; Thomas P. Jones, New-Castle, Delaware, Feb. 6.

In the machine for shelling corn; Edward Newnam, Guilford county, N. C. Feb. 7.

In steam boilers, for using anthracite coal; John Barker, Baltimore, Feb. 7.

In the chair; Jacob Daley, Baltimore, Feb. 9.

In machinery for pressing bricks; Alfred B. Crossman, Huntingdon, Suffolk county, New-York, Feb. 9.

In the horizontal cast iron paint mill; Origen Packard, Wilmington, Vermont, Feb. 12.

In opening and shutting the water gate for mills, &c.; Origen Packard, Wilmington, Vermont, Feb. 12.

In burning lime and brick, and boiling kettles; Solomon Hill, New-Milford, Connecticut, Feb. 12.

In the rocking churn; John G. Philip, Kinderhook, New-York, Feb. 15.

FRENCH PATENTS,

Granted in the Fourth Quarter of 1826.

Lequart, Paris; for mouldings in brass upon wood, for mirror frames, shop-fronts, &c.—10 years.

Leriche, M. J. Paris; for the application of the machine used by the ancients, called *catapulle*, for extracting, clearing and levelling land.—10 years.

Galy-Cazalet, Paris; for an aerostatic lamp and candlestick, with a match and two combustibles.—10 years.

Bouchy, J. V. Paris; for a machine to manufacture Paris sprigs or points.—15 years.

Avril, M. Paris; for a three wheeled carriage, called a *triolet*.—5 years.

Perpigna, A. Paris; for an improved method of vaporizing water. —15 years.

Delamare, J. P. senr. Rouen; for improvements in the fabrication of orange mineral.—10 years.

Lacote, P. R. and Carulli, F. Paris; for the invention of a guitar with ten strings, called the *decacorde*.—5 years.

Paturle, Lupin and Co. and Seydoux, C. and A. Paris; for a machine called *vaudoise*, for combing wool.—15 years.

Cordier, and Daulle, Messrs. Paris; for a wool combing machine. —5 years.

Brierq, P. Lyon; for a stuff to be used instead of furs, of various patterns, called *brierque*, and for his processes for dying stuffs.—5 years.

Gounon, E. Eause; for a continued distilling apparatus by steam. —15 years.

Corout, A. St. Julien-Molin-Molette; for a loom for weaving silk, cotton, wool, &c.—10 years.

Croisat, F. Paris; for a process of making flowers in hair and silk.—5 years.

Hall, E. Paris; for a new fulling machine.—10 years.

Benoist, Mrs. Paris; for a close stool with an absorbing cover, for water closets.—10 years.

Stuckens, P. G. Paris; for an improvement in the French horn.—5 years.

L'Epine, M. Paris; for a gas generating lamp, called the *Gazolampo.*—10 years.

Larguier, P. St. Roman; for a new application of steam for heating the water used in silk spinning.—5 years.

Joseph, S. London; for new machinery to be adapted to screw presses, to increase their force.—5 years.

Poole, M. London; for a method of tanning hides, by employing the pressure of the atmospheric air.—15 years.

Wilks, J. B. London; for improvements in the evaporization of water destined for steam engines, &c.—15 years.

Pape, Mr. Paris; for a machine for piercing wood for veneering, and for turning the feet and bases of pianos, and other furniture.—10 years.

Berard, P. Lunel; for an apparatus for essaying the spirit of wine.—5 years.

Debergue, L. N. Paris; for a recipient for transporting gas.—15 years.

Poulliot, J. J. Paris; for a pneumatic regulator applicable to hydrogen gas apparatus, and fire machines.—5 years.

Leprince and Poulain, Messrs. Paris; for improvements in a cotton flatting mill.—5 years.

Hemtault, E. Paris; for a circular drag and appendages.—10 years.

Galy-Cazalat, A. Perpignan; for the invention of a percussion gun, and cartridge case complete.—10 years.

NOTICES.

The fact of Mr. Harding's printing office having been destroyed by fire, renders all apology for the delay of this number unnecessary.

The article on extracting the fecula from starch, shall appear, as soon as the requisite engravings can be finished.

Our notice of the "Mechanics' Assistant," which has been so long delayed, is again forced out, by the accident above named: we hope that a similar reason will not prevent its appearance in our next.

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